InterStream®

Packet Networking Card User's Guide

IS2120 – 1 Gbps GbEx2 PNET PCI CARD
IS2121 – 10/100/1000BASE-T GbEx2 PNET PCI CARD
IS2122 – 1 Gbps SFP GbEx2 PNET PCI CARD

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SYSMATE INC

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0 Contents

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1 Document Outline

This chapter describes overall outlines of the document - the scope, the purpose and the conventions – and defines abbrevations used in the document.

Scope of this Document

This document describes the installations of ISPNET cards and the device driver. It also explains how to run ISPNET sample programs.

Purpose of this Document

The purpose of this document is to provide information not only ISPNET cards installation but also user applications development.

Conventions

Italicized sentences describe either specific or additional information under specific situations, not design concepts.

Abbrevations

- **IS**: InterStream®, InterStream
- **GBE**: Gigabit Ethernet
- **IPS**: Intrusion Prevention System
- **FPGA**: Field-Programmable Gate Array
- **ISN**: InterStream Networks
- **PCAP**: Packet Capture
- **PNET**: Packet Network

2 Introduction

This chapter introduces IS2120, IS2121 and IS2122 – ISPNET card package, key functions and system configuration.

ISPNET Cards

The ISPNET card provide packet transmission and monitoring for 10/100/1000 BASE-T(IS2121) or 1G-SFP(IS2122) or 1Gbps(IS2120) Ethernet. It can be easily installed in a user system which supports the standard PCI-X 64-bit 100/133 MHz interface. The kinds of ISPNET card are followings:

- InterStream® IS2120 1Gbps GbEx2 PNET Card
- InterStream® IS2121 10/100/1000BASE-T GbEx2 PNET Card
- InterStream® IS2122 1G-SFP GbEx2 PNET Card

ISPNET Package

It is provided as a package including followings:

- InterStream® ISPNET Card (i.e. One of ISPNET card's kinds)
- A compact disk which contains InterStream® drivers and example programs
- InterStream® ISPNET Card User's Guide
- InterStream® ISN Network Library User's Guide

ISPNET Key Functions

The ISPNET card captures packets from gigabit Ethernet links without losses, and delivers the packets to the user application. It also provides selective packet transmission by users' demands.

The ISPNET card implements a high performance FPGA logic which decodes received packets from the Ethernet links, and delivers them to the host memory. The FPGA logic enables to maximize performance regardless of packet size and PPS (Packets per Second).

The ISPNET package enables easy integration with user applications by providing optimized device driver software and PCAP library.

Dual 1Gbps Ethernet Interfaces

The ISPNET card provides dual 10/100/1000BASE-T or 1G-SFP Ethernet interfaces, in each of which an optical module operates in 1250 MHz.

PCI-X 64bit 100/133MHz Bus Interface

The ISPNET card supports PCI-X 64-bit 100/133 MHz bus interface. Thus, it can reduce host CPU time and memory usage for delivering packets into the system memory.

Packet Processing Engine

The ISPNET card implements a hardware-based packet processing engine which decodes and delivers packets into the system memory, improving overall system performance by minimizing CPU usage. The ISPNET card and its driver software have been optimized for packet reception performance so that we guarantee high performance and reasonable packet delivery latency.

Supporting Linux Operating Systems

The ISPNET package runs on 32- or 64-bit Linux Kernel 2.4.x or 2.6.x versions.

ISN Network Library

ISN Network Library provides functions to control and monitor ISPNET card, facilitating the integration with user applications.

Optimized PCAP Library

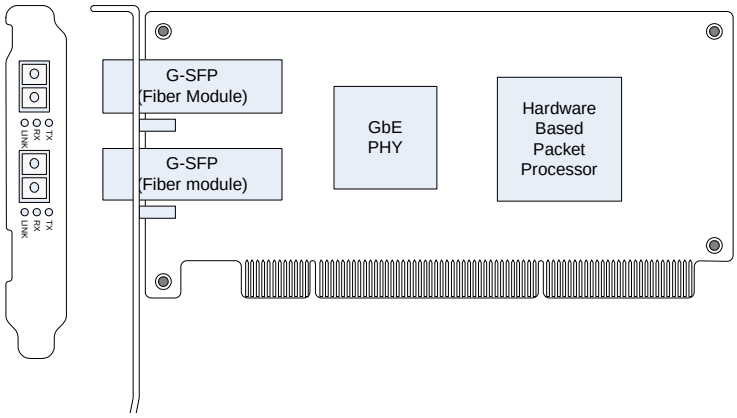
Together with ISN Network Library, we provide Optimized PCAP Library which has been rewritten to support ISN cards. Since Optimized PCAP Library provides same APIs as the standard PCAP library, it facilitates to integrate existing applications. Using the Optimized PCAP Library, it is possible to achieve high performance which is almost same as the performance obtained by ISN Network Library.

Technical Support for Integration and Customization

Sysmate Inc. spares no effort in supporting system integration and customization. In particular, we are open to develop customized hardware logics, for example, packet filter engine and pattern matching engine.

Outward Form of IS2120 Card

[Figure 1] shows the IS2120 card which consists of dual G-SFP Ethernet interfaces, GbE PHY chipset, and the FPGA packet processing engine. The received packets by the hardware chipsets are delivered to system memory via PCI-X bus.

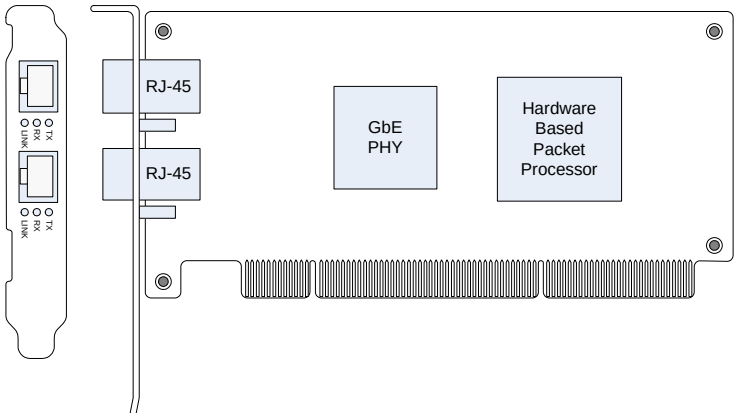


[Figure 1] IS2120 1Gbps GbEx2 PNET Card Configuration

The bracket shown in left side of [Figure 1] shows the front view when the card is installed in the system. There are two G-SFP Ethernet connectors and LED lights for link status as well as sending and receiving status. (Note: Only G-SFP(optical fiber) interface is supported in IS2120)

Outward Form of IS2121 Card

[Figure 2] shows the IS2121 card which consists of dual 10/100/1000BASE-T Ethernet interfaces, GbE PHY chipset, and the FPGA packet processing engine. The received packets by the hardware chipsets are delivered to system memory via PCI-X bus.

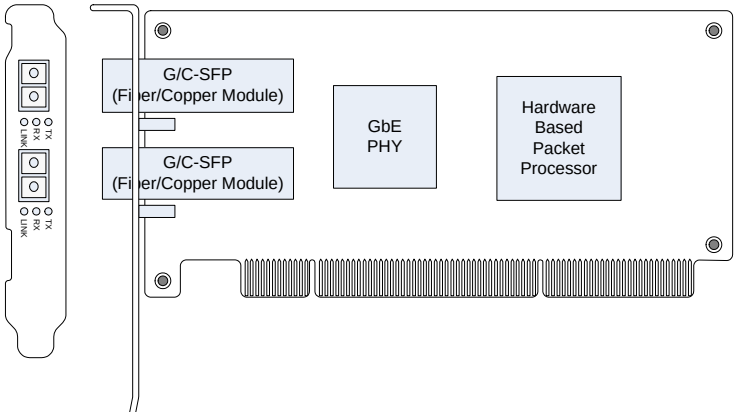


[Figure 2] IS2121 10/100/1000BASE-T GbEx2 PNET Card Configuration

The bracket shown in left side of [Figure 2] shows the front view when the card is installed in the system. There are two 10/100/1000BASE-T Ethernet connectors and LED lights for link status as well as sending and receiving status. (Note: Only 10/100/1000BASE-T(RJ-45 copper) interface is supported in IS2121)

Outward Form of IS2122 Card

[Figure 3] shows the IS2122 card which consists of dual G-SFP or C-SFP Ethernet interfaces, GbE PHY chipset, and the FPGA packet processing engine. The received packets by the hardware chipsets are delivered to system memory via PCI-X bus.



[Figure 3] IS2122 1G-SFP GbEx2 PNET Card Configuration

The bracket shown in left side of [Figure 3] shows the front view when the card is installed in the system. There are two G-SFP/C-SFP Ethernet connectors and LED lights for link status as well as sending and receiving status. (Note: Both 1G G-SFP(optical fiber) and 10/100/1000BASE-T C-SFP(Copper-SFP) interface are supported in IS2122)

3 ISPNET Card Installation

This chapter describes ISPNET card installation prerequisites and procedures.

Prerequisites for ISPNET Installation

Make sure that your system, in which the ISPNET card will be installed, satisfies following requirements before installing that card.

Prerequisites of 32-bit Linux Systems

Following prerequisites should be required to install the ISPNET card in **32-bit Linux systems**:

- A system, which has either Pentium or Xeon processor(s), and runs a 32-bit Linux operating system.
- At least one 64-bit PCI-X slot supporing PCI-X v1.0 64-bit 100/133 MHz standard
- At least 256MB system memory
- Linux Kernel version 2.4.x or 2.6.x

Prerequisites of 64-bit Linux Systems

Following prerequisites should be required to install the ISPNET card in **64-bit Linux systems**:

- A system, which has either Pentium or Xeon processor(s), and runs a 64-bit Linux operating system.
- At least one 64-bit PCI-X slot supporing PCI-X v1.0 64-bit 100/133 MHz standard
- At least 256MB system memory
- Linux Kernel version 2.4.x or 2.6.x

Checkpoints before Installing ISPNET

We recommend ensuring following checkpoints before installing the ISPNET card:

1. Make sure that the system, in which the ISPNET card will be installed, satisfies all prerequisites
2. Make sure the BIOS of the system up-to-date
3. Shutdown the system (by using Linux commands, e.g. init0).
4. Unplug the power cord of the system.
5. Check the contents of ISPNET package to make sure that it contains all elements and there is no breakage in the card in appearance. Please contact your product supplier if there is any problem.

Installation of ISPNET Card

Installing ISPNET Card

Follow the instructions to install ISPNET card:

1. Make sure the power cord of your system unplugged.
   [CAUTION] The card might be damaged if the power cord is not unplugged even though the system power is off.
2. Choose a PCI slot for the ISPNET card, and then insert it to that slot. The ISPNET card works properly only if it is installed in either a PCI-X 100 or 133 MHz slot. If you are unaware of PCI slot specification in your system, please refer to the system manual.
   [NOTE] ISPNET card works best in PCI-X 64-bit 133MHz slots.
3. Since ISPNET card has been designed to support PCI-X 64-bit interface only,
   [CAUTION] Make sure to insert card into the 64-bit slots (i.e. not into 32-bit slots)
4. Plug the power cord, and start up the system.

Connecting Network Cables

Follow the instructions to connect to the network after installing the ISPNET card:

1. The ISPNET card supports 10/100/1000BASE-T Copper(RJ45) or Gigabit Ethernet MMF optical fiber interface, so get ready the cables.
2. Remove the dust from protection cap of the installing ISPNET card, and connect the MMF fiber cables to the card
3. Check whether the connected port works properly by examining link LEDs in the ISPNET card. If the link status does not show ON, make sure the opposite sides of the cables are connected correctly.

ISPNET GbE Interface LEDs

The ISPNET card has LEDs to examine the status of each port in the card. [Table 1] summarizes LEDs in the ISPNET card.

[Table 1] ISPNET GBE interface LEDs

LED-1/2	Status	Description
Link	On	The link works in normal
	Off	The link does not work due to some problems such as improper connection, cable fault, etc
RX	Blinking	Packets are coming in from the network
	Off	No packet is coming in from the network
TX	Blinking	Packets are going out to the network
	Off	No packet is going out to the network

4 ISPNET Linux Driver Installation

This chapter describes Linux driver installation and configuration for the ISPNET card.

Checkpoints before Installing ISPNET Linux Driver

The ISPNET device driver is provided as follows:

- A compressed TAR file, which includes compiled binary files according to Linux distribution and kernel version
- The TAR file has a naming convention as follows:
  ispnet-<revision>-<target>.tar.gz
  * revision: ISPNET software package version number
  * target: targeted Linux version
- For example, in the case that Linux distribution is SuSE-10.0-x86_64 and ISPNET driver version is 1.1.0, the TAR name would be as follows:
  ispnet-rev-1.1.0-suse-10.0-x86_64.tar.gz

[NOTE] Before installing the driver, please make sure the driver version is compatible to Linux version of your system. If you can not find the compatible driver, you need to contact the product supplier.

[CAUTION] The ISPNET card might not work properly if the Linux and kernel versions of the driver mismatch to the system.

Installation of the ISPNET Driver

Follow the instructions to install the ISPNET driver:

1. Decompress the driver TAR file as follows:
   $ tar xvvzf ispnet-<rev>-<target>.tar.gz
2. As a result of the step 1, driver files will be placed in ./ispnet-<rev>-<target> directory.
3. Load the driver into Linux as follows:
   $ cd ispnet-<rev>-<target>/bin
   $ insmod ispnet.ko

ISPNET Directory and Files

[Figure 4] shows the directory and the files after the driver tar file is extracted.

```
$ ls -l
drwxr-xr-x   2 isn users  344 Jan  5 01:27 bin
drwxr-xr-x   2 isn users  248 Feb 11 23:04 include
drwxr-xr-x   2 isn users  384 Jan 19 03:05 lib
drwxr-xr-x   2 isn users  520 Jan 19 02:10 sample
-rw-r--r--   1 isn users 2304 Nov 16 04:23 Makefile
-rw-r--r--   1 isn users 1827 Oct 19 21:02 config.mk
```

[Figure 4] ISPNET TAR contents

The bin directory holds driver image files and utility files. The include directory holds ISN library header files for API function prototypes and data structures, while lib directory holds ISN library file. In addition, we provide example source codes for both ISN library and PCAP library in sample directory, and “Makefile” and “config.mk” are used to compile the example programs.

ISPNET Driver Interfaces

There are two interfaces to control the card as well as to receive packets:

- Driver Control Interface, which requires a Linux network interface (e.g. is0, is1, etc), provides functions to control the card.
- Data Reception Interface, which requires a Linux device file (e.g. /dev/isa0, /dev/isb0, etc), provides functions to receive packets.

The command “isconfig” is to configure and examine ISPNET card. Like “ifconfig” in Linux, isconfig requires a network interface name, such as “is0”. On the other hand, a Linux device file name is required as an argument to control packet reception. That is, application programs can read packets from the given device file by using file system functions, provided in ISN library or PCAP library. For further details of the libraries, please refer to the relevant documents.

ISPNET Control Interface Configuration

As mentioned, ISPNET control interface requires a network interface. In general, Linux systems assign a unique name to identify an Ethernet interface (e.g. eth0). Similarly, network interfaces in ISPNET card has unique names such as “is0”, “is1”, and so on. For those interfaces, it is possible to use “ifconfig” command to control them just like traditional Ethernet interfaces. Furthermore, the “isconfig” command can be used for more specific functions provided for ISPNET card. Such network interfaces’names should be registered when the ISPNET driver is loaded into the Linux operating system.

ISPNET Data Reception Interface Configuration

ISPNET requires a device file to receive packets from the relevant ISPNET card. In other words, the corresponding device file should be created prior to reading packets from each port in the ISPNET card, and then it is possible to receive packets from the port using the created device file. Hence the device file should have a unique name to identify each port in the system. For example, in a system which has two ISPNET cards, the name “/dev/isa0” refers to port 0 in the first card, while the name “/dev/isb0” refers to port 0 in the second card. Likewise, the name “/dev/isa1” and “/dev/isb1” refer to port 1 in the first card and port 1 in the second card, respectively. According to the naming convention, the letter after “is” (e.g. “a”, “b”, etc) identifies each card, and the number after the card identifier (e.g., “0”, “1”, etc) distinguishes each port in the card.

```
$ mknod /dev/isa0 c 100 0
$ mknod /dev/isa1 c 100 1
$ mknod /dev/isb0 c 101 0
$ mknod /dev/isb1 c 101 1
```

[Figure 5] Example of ISPNET device file creation

To create device files relevant to an ISPNET card, the command “mknod” should be used, as shown in [Figure 5]. After creating devices files once, it is possible to use them permanently. Depending on the Linux version, however, it sometimes requires to edit “/etc/MAKEDEV” file in order to create the device files automatically in the system booting time.

ISPNET Card Status

After installing the ISPNET card and the relevant driver in the system, it is possible to examine the status of the ISPNET card and the driver by using “isconfig” command. As mentioned, “isconfig” command provides more specific functions compared to traditional “ifconfig”.

[CAUTION] InterStream hardware and software has been upgraded by users’ demands. Hence, the functions of “isconfig” might be different depending on the versions of hardware and/or the driver, so you need to make sure the versions in the release note before installing the card.

ISPNET Card Operation Status

To check the operation status of the ISPNET card, you can run the command “isconfig”, as shown in [Figure 6].

```
$ ./isconfig is0
is0     InterStream 2028 1 Gbps GbEx2 PNET Card (with Replay), PCIX-64bit-100/133Mhz
        Interface:up dma:dac interrupts:1 rxp:0 txp:0 phy:0
        SPPE version-1.00-20061204 base:c3255200h irq:233
        HPPE version-0.01-20061204 base:0000c000h
             FOD-mode:inline FOD-count:0 TS-enable:20061208-15:52:09.327144
        Port0 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:370637 drops:153004 errors:0 bytes:292852199
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20231127-18:37:38.1768449894
              packets:790 drops:0 errors:0 bytes:625228
         USER dev:/dev/isa0 no users
        Port1 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:4 drops:0 errors:0 bytes:3053
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20061208-15:46:50.218189
              packets:4 drops:0 errors:0 bytes:3037
         USER dev:/dev/isa1 no users
```

[Figure 6] Example of ISPNET card operation status

ISPNET Link Operation Status

To examine whether the cable is properly connected to the ISPNET Gigabit Ethernet port, you can run “isconfig” command, as shown in [Figure 7].

```
$ ./isconfig is0
is0     InterStream 2028 1 Gbps GbEx2 PNET Card (with Replay), PCIX-64bit-100/133Mhz
        Interface:up dma:dac interrupts:1 rxp:0 txp:0 phy:0
        SPPE version-1.00-20061204 base:c3255200h irq:233
        HPPE version-0.01-20061204 base:0000c000h
             FOD-mode:inline FOD-count:0 TS-enable:20061208-15:52:09.327144
        Port0 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:fail SYNC:fail ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:370637 drops:153004 errors:0 bytes:292852199
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20231127-18:37:38.1768449894
              packets:790 drops:0 errors:0 bytes:625228
         USER dev:/dev/isa0 no users
        Port1 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:fail SYNC:fail ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:4 drops:0 errors:0 bytes:3053
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20061208-15:46:50.218189
              packets:4 drops:0 errors:0 bytes:3037
         USER dev:/dev/isa1 no users
```

[Figure 7] Example of ISPNET link operation status (abnormal status)

To make sure that the link works normally, four data - LINK, SYNC, ROOL, and DOOL – should be examined. If all of them have “ok” values, the status of the link is normal; otherwise, it means the link does not work properly due to some problems such as cable connection error. [Figure 7] shows an example that shows the links are in abnormal status. Please refer to “Troubleshooting” chapter to resolve this kind of problem.

When the cable is correctly connected between the ISPNET card and the peer system, the link operation status will be displayed as shown in [Figure 8].

```
$ ./isconfig is0
is0     InterStream 2028 1 Gbps GbEx2 PNET Card (with Replay), PCIX-64bit-100/133Mhz
        Interface:up dma:dac interrupts:1 rxp:0 txp:0 phy:0
        SPPE version-1.00-20061204 base:c3255200h irq:233
        HPPE version-0.01-20061204 base:0000c000h
             FOD-mode:inline FOD-count:0 TS-enable:20061208-15:52:09.327144
        Port0 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:370637 drops:153004 errors:0 bytes:292852199
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20231127-18:37:38.1768449894
              packets:790 drops:0 errors:0 bytes:625228
         USER dev:/dev/isa0 no users
        Port1 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:4 drops:0 errors:0 bytes:3053
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20061208-15:46:50.218189
              packets:4 drops:0 errors:0 bytes:3037
         USER dev:/dev/isa1 no users
```

[Figure 8] Example of ISPNET link operation status (normal status)

[Table 2] summarizes ISPNET link operation status.

[Table 2] ISPNET link operation status

	Value	Description
LINK	ok	The link is correctly connected to the peer.
	fail	The link is NOT connected to the peer.
SYNC	ok	The link successfully synchronizes to the peer.
	fail	The link fails to synchronize to the peer.
ROOL	ok	MAC layer transmission and reception reference is Out Of Lock.
	fail	MAC layer transmission and reception reference is NOT Out Of Lock.
DOOL	ok	MAC layer data is Out Of Lock.
	fail	MAC layer data is NOT Out Of Lock.

ISPNET Packet Reception

The “isconfig” command can be used to start and terminate packet reception from the ISPNET card.

- The following command is to start up packet reception from the ISPNET card (for example, is0 interface).
  $ isconfig is0 up

- On the other hand, the following command is used to terminate packet reception from the interface.
  $ isconfig is0 down

```
./isconfig is0
is0     InterStream 2028 1 Gbps GbEx2 PNET Card (with Replay), PCIX-64bit-100/133Mhz
        Interface:up dma:dac interrupts:1 rxp:0 txp:0 phy:0
        SPPE version-1.00-20061204 base:f6d9bc00h irq:233
        HPPE version-0.01-20061204 base:0000c000h
             FOD-mode:inline FOD-count:0 TS-enable:20061208-16:01:34.089859
        Port0 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:284071 drops:66974 errors:0 bytes:224525330
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20211009-00:10:22.1701077858
              packets:144 drops:0 errors:0 bytes:118019
         USER dev:/dev/isa0 user:pmon pid:7698 hf:6h
              START POL read_timeout:0(msec) snaplen:1536 cpu:0
              RX packets:15 drops:0 errors:0 bytes:0
              TX packets:15 drops:0 errors:0 bytes:0
        Port1 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:2 drops:0 errors:0 bytes:729
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20061208-15:58:33.138138
              packets:2 drops:0 errors:0 bytes:721
         USER dev:/dev/isa1 user:pmon pid:7694 hf:6h
              START POL read_timeout:0(msec) snaplen:1536 cpu:0
              RX packets:0 drops:0 errors:0 bytes:0
              TX packets:0 drops:0 errors:0 bytes:0
```

[Figure 9] ISPNET packet reception status

In [Figure 9], “interface:up” means that the interface has been started to receive packets. In the case that the interface is terminated packet reception, the status will be changed like “interface:down”. The “RX-PATH” displays packet reception status in GbE PHY chip; that is, “RX-PATH-enable” implies that packets have been received in the PHY chip normally. This “RX-PATH” value is

changed to enable in the case that the link has been connected properly and the start-up command has been triggered.

ISPNET Statistics

The “isconfig” command can be also used to examine statistics for the card and the driver. In addition, it displays packet reception statistics of ISPNET applications. [Figure 10] shows an example. In the figure, each port has “RX” statistics, which include the number of packets received in the hardware, the number of packets dropped in the hardware, the number of error packets detected in GbE PHY, and total number of bytes of received packets. The error packets include CRC error packets and length error packets. The statistics are basically obtained by reading 32-bit long registers, so the values can be wrapped around (i.e. overflown).

```
./isconfig is0
is0     InterStream 2028 1 Gbps GbEx2 PNET Card (with Replay), PCIX-64bit-100/133Mhz
        Interface:up dma:dac interrupts:0 rxp:0 txp:0 phy:0
        SPPE version-1.00-20061204 base:d4fc5e00h irq:233
        HPPE version-0.01-20061204 base:0000c000h
             FOD-mode:inline FOD-count:0 TS-enable:20061208-16:07:45.427489
        Port0 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:1903096 drops:0 errors:0 bytes:243596288
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20061208-16:07:40.278842
              packets:1903096 drops:0 errors:0 bytes:235983904
         USER dev:/dev/isa0 user:pmon pid:7945 hf:6h
              START POL read_timeout:0(msec) snaplen:1536 cpu:0
              RX packets:1903096 drops:0 errors:0 bytes:0
              TX packets:1903096 drops:0 errors:0 bytes:0
        Port1 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets:192653 drops:0 errors:0 bytes:24659584
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              TSTAMP:20061208-16:07:40.278846
              packets:192653 drops:0 errors:0 bytes:23888972
         USER dev:/dev/isa1 user:pmon pid:7939 hf:6h
              START POL read_timeout:0(msec) snaplen:1536 cpu:0
              RX packets:192653 drops:0 errors:0 bytes:0
              TX packets:192653 drops:0 errors:0 bytes:0
```

[Figure 10] Example of ISPNET statistics

In [Figure 10], “USER” field displays the relevant device file and statistics for applications: “RX packets” shows total number of received packets, the number of dropped packets, the number of error packets, and the number of total

bytes of the packets received in applications from the device file. For the reasons of error packets, please refer to PCAP Library User's Guide or ISN Library User's Guide.

[NOTE] "TX packets" under "USER" field simply displays transmission statistics (compared to "RX packets" field).

ISPNET GBE PHY Status

By using the command "isconfig", it is possible to examine ISPNET GBE interfaces, as shown in [Figure 11].

```
$ ./isconfig is0:0 port
is0     InterStream 2028 1 Gbps GbEx2 PNET Card (with Replay), PCIX-64bit-100/133Mhz
        Interface:up dma:dac interrupts:1 rxp:0 txp:0 phy:0
        SPPE version-1.00-20061204 base:d4fc5000h irq:233
        HPPE version-0.01-20061204 base:0000c000h
             FOD-mode:inline FOD-count:0 TS-enable:20061208-16:14:44.188551
        Port0 OC-1G:GBE SUNI/3386-revA base:10004000h
              SENSE:auto AUTO:bypass LINK:ok SYNC:ok ROOL:ok DOOL:ok
           RX PATH-enable FLCHK-disable PUREP-enable LONGP-disable FC-disable
              packets: 205097 fcs:0 symbol:0 len:0 min:0 max:0 drop:0
              bytes: 162290439
           TX PATH-enable PADEN-enable CRCEN-enable FC-disable
              packets: 307 system:0 drop:0, bytes:237031
```

[Figure 11] ISPNET GbE PHY status

The detailed information is as follows:

- FLCHK: enable/disable

  A flag to indicate whether the length of the frame received in GbE PHY is tested
- PUREF: enable/disable

  A flag to indicate whether the preamble of the frame received in GbE PHY is tested
- LONGP: enable/disable

  A flag to indicate whether the uploaded packets from GbE PHY include the 12-byte preamble
- FC: enable/disable

  A flag to indicate whether IEEE 802.3-1998 flow control is enabled in

GbE PHY

- PADEN: enable/disable

  A flag to indicate whether padding is enabled for transmission

- CRCEN: enable/disable

  A flag to indicate whether CRC is used for transmission

[NOTE] Above options are initial set to ISPNET GbE PHY. If you need to change these options, please contact us.

In [Figure 11], “TX” and “RX” fields display the transmission and reception statistics of GbE PHY. The statistics values are reset whenever “isconfig” command is triggered. Sometimes there might be error frames transiently due to GbE PHY initialization. If the number of dropped frames still shows non-zero even after repeating “isconfig” command, it means the port does not work properly. In this case, please contact the product supplier.

ISPNET Card and Driver Configuration

ISPNET Card Pause and Resume

It is possible to pause and resume packet reception in the ISPNET card.

The following command is to pause packet reception for the ISPNET network interface “is0”.

- $ isconfig is0 down

The following command is to resume packet reception for the network interface “is0”.

- $ isconfig is0 up

By doing so, you can pause and resume packet reception in the ISPNET card.

5 ISPNET Example Programs

This chapter introduces example programs for the ISPNET card. There are two packet reception interfaces for the user applications. The one is PCAP library interface which is one of Linux open software, and the other is ISN library provided by Sysmate Inc. This chapter provides examples of both interfaces (PCAP library and ISN library), and describes how to run the examples. Please refer to PCAP Library User's Guide and ISN Library User's Guide for detailed functions and APIs.

ISN Library Examples

PMON Example

PMON example program, which is located in "bin/pmon" directory, displays packet reception statistics by calling ISN library. This example shows a way that how to use ISN library to receive packets from the ISN card.

To run the pmon example, just type the following command in the "bin/pmon" directory.

- $ pmon pmon.isa0.config

When running the example, it displays statistics as shown in [Figure 12] and updates every 2 seconds.

```
PMON:   InterStream IS2028-PMON-GBE Card
        TX/RX status from 2006/12/08 16:18:48 to 2006/12/08 16:20:08
        Running time:  0 hour 1 min 19 sec
        CARD: UP
        LINK: RXEN:enabled TXEN:enabled SENSE:enabled AUTO:disabled LINK:ok SINK:ok
ROOL:ok DOOL:ok

PMON: Packet statistics in applications(/dev/isa0)
      RX:           191309 (       0M) packets,      0.0 kpps,         0 errs
                         0 (       0M) drops,        0.0 kpps       0.0% dropped
     PKT:        151313734 (     151M) bytes,        0.0 kbps
     CAP:        151313734 (     151M) bytes,        0.0 kbps
                     59687 (       0M) reads,          0 errs
```

[Figure 12] PMON example

As shown in [Figure 12], PMON displays the number of packets and packet-per-second by reading from the relevant device file. The “PKT” line shows byte level statistics of the packets in the link, while the “CAP” line shows byte level statistics of the packets captured by the ISPNET card.

PCAP Library Examples

PCAP Example

PCAP example does same function as PMON example described above. The only difference is that it uses PCAP library instead of ISN library. The example is located in “bin/pcap” directory, and displays packet reception statistics by calling PCAP library.

To run the pcap example, just type the following command in the “bin/pcap” directory.

- $ pcap pcap.isa0.config

When running the example, it displays statistics as shown in [Figure 13] and updates every 2 seconds.

```
PCAP:  InterStream IS2028-PCAP-GbE Card
       TX/RX status from 2006/02/13 22:34:32 to 2006/02/13 22:34:38
       Running time:  0 hour 0 min 6 sec

PCAP: Packet statistics in applications(/dev/isa0)
     RX:         0 (       0M) packets,    0 kpps,     0 errs
                 0 (       0M) drops,      0 kpps,  0.0% dropped
    PKT:         0 (       0M) bytes,      0 kbps
    CAP:         0 (       0M) bytes,      0 kbps
                 0 (       0M) reads,      0 errs
```

[Figure 13] PCAP example

6 ISPNET Troubleshooting

This chapter describes troubleshooting in installing and running the ISPNET card.

Checkpoints for ISPNET Card

The ISPNET card has dual 10/100/100BASE-T or 1Gbps Ethernet interface, and relevant LEDs which shows status of the port. Before checking cable connection, please make sure that the ISPNET card is installed in the system with the relevant driver provided by the package. Check followings after connecting cables to the ISPNET card:

1. Make sure that the ISPNET card is installed with the relevant driver, and the driver is running properly.
2. Connect cables to the ISPNET port, and make sure the Link LED is green. **[Troubleshooting]** If the Link LED shows other than green, swap the position of the cables; that is, change “TX” and “RX” positions of the cables. If there is still the same problem, it is usually because either the peer system is not properly working or cables are at fault.
3. Check the link status of the port using “isconfig” command when Link LED shows green. All flags – LINK, SYNC, ROOL, DOOL – should be “ok”; otherwise it implies that the port is not connected properly.
   [Troubleshooting] It is possible for the gigabit Ethernet PHY interface to configure some settings such as “auto-negotiation” and “auto-sensing”. If the configured options do not match to the peer system, the above flags do not reveal “ok” status. Please refer to ISPNET driver options in this document to change the options. If there is still a problem even after reconfiguring the options, please contact the product supplier.
4. If there are no such problems as mentioned above, it implies that the port works properly. Check if “RX” LED blinks when the peer system transmits packets. In addition, you can check the statistics by using the

“isconfig” command.

Checkpoints for the System

Please refer to the followings, if your system can not boot up after installing the ISPNET card or your system can not discover the card.

System Boot-up Failure after Installing the ISPNET Card

Check followings if your system fails to boot up after installing the ISPNET card:

1. Make sure that the ISPNET card is installed in a PCI-X 64-bit 100/133 MHz slot properly.

   [Troubleshooting] ISPNET card works best in PCI-X 64-bit 100/133 MHz interface slots. In other words, ISPNET cards might not work properly if the cards are installed in 32-bit PCI slots or 66MHz 64-bit PCI slots. Please make sure that your system supports the relevant PCI-X interfaces and the ISPNET card is installed in the right slot.

2. Check if BIOS in your system has been updated with the most recent one.

   [Troubleshooting] Even if your system has the proper PCI-X slots for ISPNET cards, there might be problems if the BIOS does not support the PCI-X interface. Please make sure BIOS in your system supports the PCI-X interface.

3. If you have another PCI-X slot, you can change from the old one to the new slot for the ISPNET card to resolve the problem.

   [Troubleshooting] Some PCI-X slots can not work properly due to several system problems. In this case, you can change the slot to install the ISPNET card, and test it again.

4. If you have other PCI cards in the system, you can test the ISPNET card solely after removing all other PCI cards.

   [Troubleshooting] If the system works properly after removing all other PCI cards, it can be explained that there is a collision between the ISPNET card and one of the removed PCI cards.

5. If you still have problems, it could be problems caused by either your system or the ISPNET card.

   [Troubleshooting] You can install the ISPNET card in another system, or please contact the product supplier.

Driver Loading Failure after System Boot-up

Check followings if your system fails to load the driver for the ISPNET card:

1. In the case of kernel panic or system down when loading the driver, please refer to section System boot-up failure after installing the ISPNET card.
2. If your system can not discover the ISPNET card when loading driver, you can use “lspci” command to check whether the ISPNET card is successfully installed in the system. as follows:
   02:03.0 Ethernet controller: Xilinx Corporation: Unknown device 1000
3. If you still have problems, please contact the product supplier.

Linux Driver Loading Status

The command “lsmod” can be used to examine ISPNET driver status. [Figure 14] shows an example of ISPNET driver status.

```
$ lsmod
Module                  Size  Used by
is_driver              93540  2
hfsplus                93316  0
vfat                   30336  0
fat                    68636  1 vfat
...
```

[Figure 14] Example of ISPNET driver status

Appendix A IS2120 Specification

Monitoring Interface Specifications

Feature	Specification
Interface	1000 BASE-SX * 2 EA
Media type	GbE User-Network Interface operating at 1250 Mbps
Connector	1.25Gbps MMF 850nm SFP(Small Form Factor Pluggable) LC-Duplex

Monitoring Network Specifications

Supports Ethernet 2.0, IEEE 802.3 LLC and IEEE 802.3 SNAP/LLC encoding formats and VLAN tagged frames

Verifies frame integrity (i.e. FCS and length checks).

Automatic base page Auto_Negotiation.

Provides port statistic counters needed to support the standards 802.3-1998, SNMP, and RMON Management Information Base(MIB) implementations.

PCI Bus Specifications

Feature	Specification
PCI-X clock	100/133 MHz (max)
PCI Data/Address	64 bit and 32 bit
PCI modes	Master/slave

Hardware Packet Processor Specifications

Full 1Gbps line speed packet processing engine

Packet reception/transmission statistics

Physical Characteristics

Dimension	Measurement
Length	64.41 mm
Width	167.64 mm

Power Requirements

Specification	Measurement
Operating voltage	+3.3V
Power consumption	Less than 6 Watts

Environmental Specifications

Condition	Operating Specifications
Temperature	0 ℃ to 55 ℃
Relative humidity	5 % to 85 %

Appendix B IS2121 Specification

Monitoring Interface Specifications

Feature	Specification
Interface	10/100/1000 BASE-T * 2 EA
Media type	10/100/1000BASE-T User-Network Interface
Connector	Copper Media (RJ-45)

Monitoring Network Specifications

Supports Ethernet 2.0, IEEE 802.3 LLC and IEEE 802.3 SNAP/LLC encoding formats and VLAN tagged frames

Verifies frame integrity (i.e. FCS and length checks).

Automatic base page Auto_Negotiation.

Provides port statistic counters needed to support the standards 802.3-1998, SNMP, and RMON Management Information Base(MIB) implementations.

PCI Bus Specifications

Feature	Specification
PCI-X clock	100/133 MHz (max)
PCI Data/Address	64 bit and 32 bit
PCI modes	Master/slave

Hardware Packet Processor Specifications

Full 1Gbps line speed packet processing engine

Packet reception/transmission statistics

Physical Characteristics

Dimension	Measurement
Length	64.41 mm
Width	167.64 mm

Power Requirements

Specification	Measurement

Operating voltage	+3.3V
Power consumption	Less than 8 Watts

Environmental Specifications

Condition	**Operating Specifications**
Temperature	0 ℃ to 55 ℃
Relative humidity	5 % to 85 %

Appendix C IS2122 Specification

Monitoring Interface Specifications

Feature	Specification
Interface	10/100/1000 BASE-T * 2 EA or 1000 BASE-SX * 2 EA
Media type	10/100/1000BASE-T User-Network Interface or GbE User-Network Interface operating at 1250 Mbps
Connector	10/100/1000BASE-T Copper SFP(Small Form Factor Pluggable) or 1.25Gbps MMF 850nm SFP LC-Duplex

Monitoring Network Specifications

Supports Ethernet 2.0, IEEE 802.3 LLC and IEEE 802.3 SNAP/LLC encoding formats and VLAN tagged frames

Verifies frame integrity (i.e. FCS and length checks).

Automatic base page Auto_Negotiation.

Provides port statistic counters needed to support the standards 802.3-1998, SNMP, and RMON Management Information Base(MIB) implementations.

PCI Bus Specifications

Feature	Specification
PCI-X clock	100/133 MHz (max)
PCI Data/Address	64 bit and 32 bit
PCI modes	Master/slave

Hardware Packet Processor Specifications

Full 1Gbps line speed packet processing engine

Packet reception/transmission statistics

Physical Characteristics

Dimension	Measurement
Length	64.41 mm

Width	167.64 mm

Power Requirements

Specification	Measurement
Operating voltage	+3.3V
Power consumption	Less than 8 Watts

Environmental Specifications

Condition	Operating Specifications
Temperature	0 ℃ to 55 ℃
Relative humidity	5 % to 85 %

Appendix D Technical Support

Sysmate INC. wholeheartedly assists you for technical support and customizations. You can get following services for technical support.

Online Technical Support

We offer 24-hour technical support in the Internet:

- Sysmate web-site technical support
- Sysmate e-mail technical support

Web-site Technical Support

You can obtain InterStream products and technical support information in the following web site:

http://www.sysmate.com

E-mail Technical Support

You can contact us for technical support by e-mail:

sales@sysmate.com

Technical Support from Product Suppliers

We have many partners who supply InterStream products. To get technical support from the product suppliers, you can ask them with following information:

- Product model number and serial number
- Product package software and hardware list
- Error messages (e.g. /var/log/messages or driver level error messages)
- System and InterStream card setting options

ISPNET Card USER'S GUIDE

IS-PNET(ENG)-200702-001

FCC NOTICE

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES.
OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITION:
(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
(2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDERSIRED OPERATION.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures :

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit difference from that to which the receiver is connected.

- Consult the dealer of an experienced radio/TV technician for help.

NOTE : The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user’s authority to operate the equipment.

InterStream® PNET

ISPNET PCI CARD

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