

NT4E CAPTURE

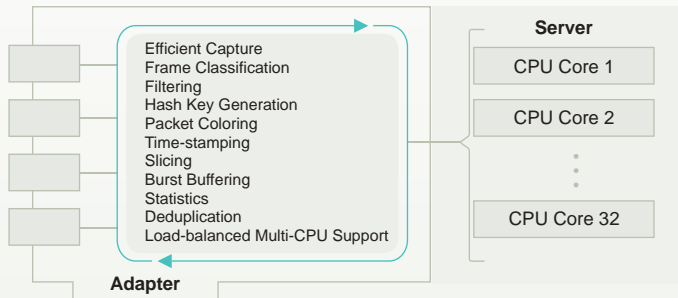
Intelligent Real-time Network Adapters 4-port 10 M / 100 M / 1 G Ethernet PCIe

DATA SHEET

Hardware Acceleration

The NT4E Capture Adapters provide deep packet inspection (DPI), flow analysis and protocol processing capabilities that can accelerate network applications and off-load the server CPU by taking care of layer 2 to 4 network traffic analysis.

This enables OEM customers to build or upgrade their products to become high-performing full-line-rate 4 or 8 Gbps network monitoring/analysis systems by using the NT4E Capture Adapter and a standard Linux, FreeBSD or Windows server.



NT4E-4: 4 x 1 Gbps PCIe



NT4E-4T: 4 x 1 Gbps PCIe



NT4E-2+2T: 4 x 1 Gbps PCIe

FEATURE HIGHLIGHTS AND APPLICATIONS

Feature Highlights

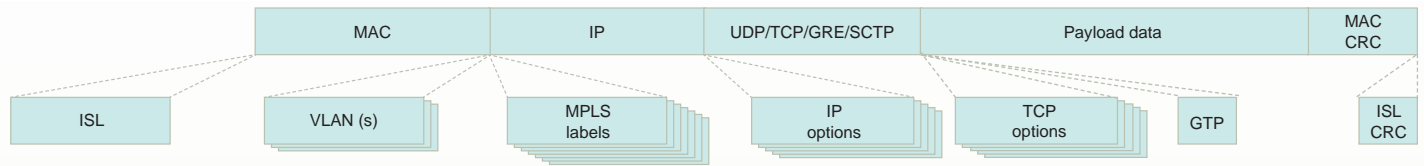
- 4 x 1 Gbps SFP and/or RJ45 connections
- Expandable to 8 ports using the NTPORT4E adapter
- Full-duplex monitoring of IPv4 and IPv6
- Full-line-rate capture and processing for all frame sizes
- Efficient capture: < 1% host CPU load
- High-precision 10 ns time-stamping
- Advanced hardware time synchronization
- 6 sec. of on-board data burst buffering
- 4 or 8 Gbps frame processing including protocol decoding, programmable filters, conditional slicing, hash keys, buffering, advanced statistics, deduplication and multi-CPU support
- On-the-fly fully reconfigurable setup
- Easy-to-integrate API
- LibPCAP and WinPCAP support
- Linux, FreeBSD and Windows support

Napatech-supported Applications

The Napatech Capture Adapters enable our OEM customers to build cost-effective and value-added appliances to meet requirements for many different solutions. Examples of supported applications are:

- Advanced Frame Analysis and Statistics
- Packet Jitter and Latency Analysis
- Flow Analysis of any IP end-to-end traffic
- Data Recording of network traffic
- Data Retention, Logging and Forensic Analysis
- Lawful Intercept
- Intrusion Detection
- Network QoS Assurance for media streams
- Transaction Performance Analysis

FEATURES



The Napatech adapters decode all frames regardless of encapsulations.

Frame Classification

The NT4E frame decoder ensures protocol recognition of all major layer 2 to 4 protocols. This is a unique advantage over any other network adapter. It provides offset information for assisting the customer application under all circumstances in a mixed-traffic environment.

Frame classification information is the foundation for the adapter to implement these advanced features:

- Finding protocol headers and payload data at dynamic locations
- Advanced filtering
- 17 different hash keys
- Dynamic selection of hash keys (per frame)
- Dynamic slicing
- Multi-CPU buffer splitting

The frame classification information can be provided to the customer application to accelerate the frame processing.

Packet Descriptors

Captured frames are appended with a standard PCAP packet descriptor. This can be augmented with additional information such as CRC error flags. Extended packet descriptors are also available with information, such as:

- Protocol information: IPv4, IPv6, UDP, TCP, GRE, SCTP and GTP
- Encapsulation information: ISL, VLAN and MPLS
- Hash key information: hash key value and type
- Offsets to information: Start of IP header, L4&L5 offsets
- Coloring/tagging: Tags defined by filters

Efficient Data Capture

The 4/8 ports on the NT4E adapters enable full-duplex monitoring of a network link (Rx and Tx traffic). The frame merging functionality enables Rx and Tx frames to be merged in reception time order simplifying the application processing.

Buffering

On-board memory enables 6 sec. of data burst buffering even on a fully loaded 4 x 1 Gbps network.

Filtering

64 advanced programmable filters are available with an exceptional flexibility in the way they are specified, combined and controlled. They are configured by means of the easy-to-use Napatech Programming Language. The customer application can change the filters on the fly without data loss.

The programmable filter logic is built on top of the advanced protocol decoding capabilities. This ensures that the application always gets the packets matching the requested protocol, even under very diverse conditions. Using a single filter, the adapter can capture, for instance, all TCP/IP packets with a specific source IP address, even when these packets are ISL-, VLAN- or MPLS-encapsulated and/or contain IP/TCP options.

In all, a single filter will give the correct output under 7744 different traffic conditions. NT4E has 64 such programmable filter blocks, which can be combined in various ways.

Filtering can be based on various combinations of:

- Bit patterns
- Protocol information
- Frame size tests
- Frame error tests
- Port number

Coloring/Tagging

Filtered frames can be tagged with a "color" ID identifying the filter that forwarded the frame. This tag can be used to optimize applications performing different processing for different frame types.

Slicing

Three slicing methods are supported:

- Fixed slicing: Truncation of frames to a maximum size
- Dynamic slicing: Truncation of frames to a dynamic size relative to a specified protocol, e.g. IP payload + 16 bytes
- Conditional slicing: Fixed or dynamic slicing with properties based on frame decoding

FEATURES

Time-stamping and Synchronization

High-precision time-stamping with 10 ns resolution is applied to all frames received by the adapter. The adapter time-stamping can be synchronized to that of another adapter or to external sources:

- Synchronization via the Napatech Time Synchronization Unit e.g. to a GPS signal via Trimble Acutime Gold GPS antenna
- Adapter-to-adapter HW time synchronization either internally, externally or using daisy-chaining of adapters
- OS time synchronization with dynamic drift adjustment
- Free-running time synchronization
- Synchronization relative to any external PPS time source
- Synchronization to UTC time from:
 - CDMA time reference when connected to EndRun Præcis CF CDMA receiver
 - IEEE1588/PTP time reference when connected to Oregano SYN1588 PCIe NIC

The NT4E Capture Adapters support 6 different 64-bit time-stamping formats:

- Native free-running format with 10 ns resolution
- 2 Windows formats with 10 ns or 100 ns resolution
- Native UNIX format with 10 ns resolution
- 2 PCAP formats with 1 ns or 1000 ns resolution

Statistics

The adapter hardware generates an extensive amount of statistics counters, which are available independently on whether the traffic is forwarded to the host or not. This enables customer applications to retrieve a comprehensive network traffic analysis at virtually zero CPU load.

Two types of statistics counters are available:

- Large sets: RMON1 (RFC2819) counters with extension of Jumbo frame counters are available for both captured and discarded frames on a per-port basis.
- Normal sets: Frame and byte counters for good and bad frames are available per filter and per host buffer.

Counter sets are always delivered as a consistent snapshot time-stamped by a 64-bit high-precision clock.

NTPL Example

```
HashMode[ Pri=0; L4Port=GTPv1-U,GTPv1v2-C ] = HashGTPv1v2Sorted
HashMode[ Pri=0; L4Type=UDP,TCP,SCTP ]      = Hash5TupleSorted
HashMode[ Pri=1; L3Type=IPv4 ]              = Hash2TupleSorted
Capture[ Pri=0; Feed=(0..3) ] = mL5Prot(GTPv1-U,GTPv1v2-C)
Capture[ Pri=1; Feed=(4..7) ] = mL4Prot(UDP,TCP,SCTP)
Capture[ Pri=2; Feed=8 ]      = mL3Prot(IPv4)
Capture[ Pri=3; Feed=9 ]      = All
Deduplication[ DynOffset     = Layer2HeaderSize ] = All
```

Deduplication

When network traffic is analyzed, large amounts of duplicate frames are sometimes received. NT4E has hardware functionality that can recognize and remove duplicate frames. This saves a substantial amount of server CPU cycles. The deduplication functionality can be configured to detect and remove 98% of duplicate frames in typical situations.

Multi-CPU Support

Multi-CPU buffer splitting enables the NT4E adapters to place captured frames in 1 – 32 host buffers. The customer can configure the size of the host buffers from 1 MB to 128 GB; and how data are placed in the host buffers, based on results from the filter logic (IP address range and protocols), port numbers and/or generated hash key values (flows).

The advanced multi-CPU buffer splitting functionality and the option for distributing traffic to 1 – 32 CPU cores significantly improves the CPU cache performance, by always delivering the same flows and frame types to the same CPUs.

Software

The network adapter drivers support Linux, FreeBSD and Windows.

The API is identical for all Napatech adapters. The adapters also support LibPCAP and WinPCAP.

NTPL (Napatech Programming Language) provides a simple and intuitive interface for programming the advanced features of the NT4E adapters. Napatech also provides a command line tool that enables fast prototyping of the adapter programming.

A large set of useful SDK tools are included in source code. These tools can be used for debugging and prototyping but also as examples of how the adapters are used. Application examples illustrating how to capture data to memory or disk, and how to generate netflow data, are also included.

This NTPL example shows how to set up the adapter to sorted GTPv1 hash keys for GTP-U and GTP-C frames, sorted 5-tuple hash keys for UDP, TCP and SCTP frames, and sorted 2-tuple hash keys for all other IPv4 frames. Then it shows how to set up the adapter to capture GTP-U and GTP-C frames and distribute them to 4 host buffers (0..3), capture UDP, TCP and SCTP frames and distribute them to 4 other host buffers (4..7), capture all other IPv4 frames and deliver them to another host buffer (8), and last capture the remaining frames to a separate host buffer (9). Finally the adapter is set up to remove duplicate frames if the layer 2 parts of the frames are identical (MAC addresses and encapsulations are excluded from the compare). All of the functionality included in the example is performed at line speed by the adapter hardware at zero server CPU load.

SPECIFICATIONS

General Features

- Full-line-rate processing for all frames from 64 bytes to 10000 bytes
- IEEE standard: IEEE 802.3 10 Mbit/s / 100 Mbit/s / 1 Gbit/s Ethernet
- Physical interfaces:
 - NT4E-4: 4 SFP ports
 - NT4E-4T: 4 RJ45 ports
 - NT4E-2+2T: 2 SFP ports and 2 RJ45 ports
- Supported SFP modules: Multimode SR (850 nm), single-mode LR (1310 nm), 1000BASE-T or 10/100/1000BASE-T
- Data rate: 4 x 1 Gbit/s or 8 x 1 Gbit/s
- PCIe performance: 12.5 Gbit/s
- CPU utilization:
 - < 1% of the CPU is used for any data transfer
 - 0% of the CPU is used for any on-board processing
- Time formats: PCAP-ns/-µs, native, NDIS 10 ns/100 ns, UNIX 10 ns

Software

- Linux kernel 2.6: 32-bit/64-bit
- FreeBSD 6.x and 7.x: 32-bit/64-bit
- Windows Server 2003/2008, XP and Windows 7: 32-bit/64-bit
- API supporting user level applications
- LibPCAP and WinPCAP support
- SDK tools included in source code for debugging and prototyping and as examples of how the adapters are used

Host Interface

- Bus type: 8-lane 2.5 GHz PCIe Gen1
- Data transfer modes:
 - Bus master DMA
 - Memory write or memory read transactions
- Support for 32-bit/64-bit addressing and host DMA addressing

Statistics

- RMON1 counters plus Jumbo frame counters per port
- Frame and byte counters per filter and per host buffer
- Counter sets always delivered as a consistent time-stamped snapshot

Adapter Hardware

- Flash: Supports two boot images
- Memory options: Standard SO-DIMM 200-pin 1 GB, 2 GB or 4 GB DDR2 RAM modules
- Physical dimensions: ½-length full-height PCIe

Environment

- Power consumption: 25 Watts including SFP SR or RJ45 modules
- Operating temperature: 0 - 45 °C, 32 - 113 °F
- Operating humidity: 20 - 80%
- Hardware compliance: RoHS, UL, CE, FCC, CSA, VCCI, C-TICK
- MTBF: 266329 hours according to RIAC-HDBK-217Plus

ABOUT NPULSE TECHNOLOGIES AND PCAP EXPRESS

nPulse Technologies, LLC is a leading provider of enterprise-class network assurance solutions. Combining open-source-based software technologies with hardware-accelerated performance on multi-core x86-based platforms, nPulse's Packet Capture Express (PCAPX) tools offer easy access to advanced packet capture functions using familiar open software and hardware architectures.

PCAP Express Adapters accelerate monitoring applications to wire-speed, transforming a standard x86 multi-core server into a flexible, high-performance platform processing millions of packets per second per core.

PCAP Express Workbench integrates PCAPX features and performance into a server appliance with pre-packaged applications and

additional tools for line-rate record-to-disk. The custom Workbench libpcap extension seamlessly enables multiple instances of a pcap-enabled application to execute in parallel across up to 32 cores, drastically scaling the throughput of network monitoring, analysis, and cyber security to 10Gbps without code modifications.

PCAP Express solutions are based on Napatech OEM adapter technology. As a value added reseller nPulse markets, sells, and supports Napatech-based solutions to developers, system integrators, and end-users under the Packet Capture Express product line.

For U.S. Federal Government customers, PCAP Express products and services are also available under GSA contract. Contact us directly for details at gsa@npulsetech.com.



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