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RECONFIGURABLE COMPUTING

2 x 100G Flow Aware Packet Processing

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Agenda

Introduction to Napatech

Market and Challenges

Flow Awareness

Use Cases

Summary

The internet of the world is growing at incredible speeds, and the data amount is challenging the network equipment.

Especially, applications targeted at monitoring, tracking and intercepting specific data and flows are already flooded.

Acceleration and offloading is needed to keep up, and FPGA based SmartNICs can provide the help needed now and, in the future, offering updates as the requirements of the future changes.

Introduction to Napatech

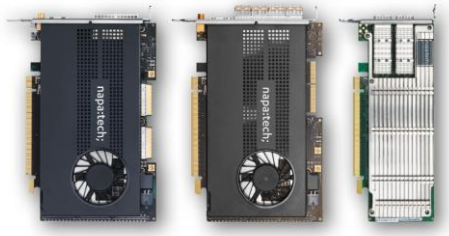
Unique Expertise Focused on Application Acceleration

- Unparalleled expertise accelerating compute-intensive applications on servers
- Danish tech company founded in 2003, listed in 2013
- Denmark HQ with 90 employees worldwide, R&D in Copenhagen
- 22 patents & patents-pending provides high barrier-to-entry for competitors
- Solid financial track-record and highly leverageable business model
- Targeting rapidly expanding programmable NIC market
- Listed NAPA:OL

Products & Services

Link-Capture™ Software
Ideal for performing high-speed packet capture with nanosecond timestamping and replay with precise inter-frame gap control.

Link-Inline™ Software
Boosts applications by offloading packet and flow processing, providing unmatched visibility and performance.



FPGA-based SmartNICs
Hardware for Capture, Inline, Virtualization and Programmable.

Link-Virtualization™ Software
Offloads and accelerates the Open vSwitch (OVS) dataplane to enhance CPU efficiency, scalability and network performance.

Link-Programmable™
Enables end-users and OEMs to deploy their own FPGA IP on Napatech's industry-proven SmartNIC platform.

Link-Assure™ Professional Services
Napatech offers various services to ensure that you get the most out of our Link™ SmartNIC hardware and software.

FPGA SmartNIC Software for Passive and Active Network Applications

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100%
Packet Capture

Replay
Exactly as captured

Flow Aware
Match and Action

Nanosecond
Timestamp Accuracy


Challenges

Challenge

- Amount of network data
- Networking and security applications are extremely CPU intensive
- Inspect and analyze network traffic
- Network speeds

Solution

Offload application processing to FPGA

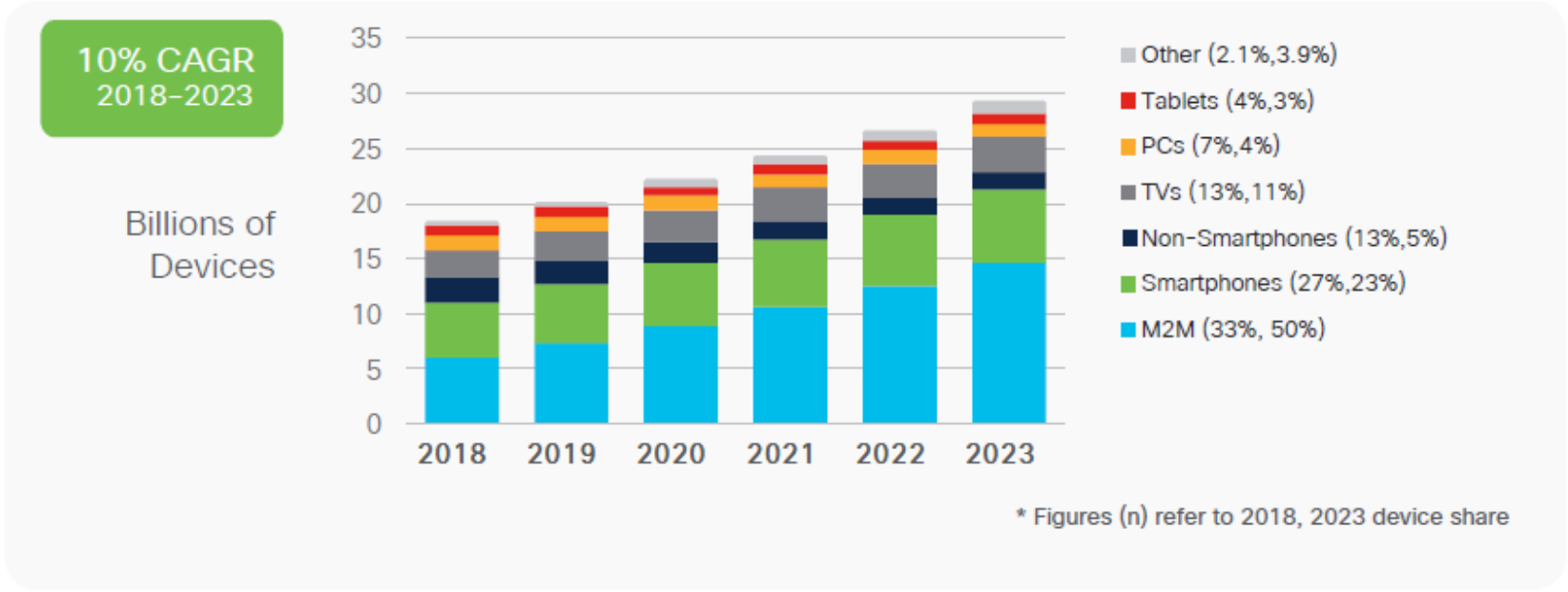
- Flow records
- Filter out irrelevant traffic flows
- Provide meta data with each packet
- Provide meta data for each terminated flow

Benefits

- Application performance
- Reduced TCO: Fewer servers, less power and cooling
- Zero packet loss

Device Mix (global)

Figure 2. Global device and connection growth



Source: Cisco Annual Internet Report, 2018–2023

- M2M (also referred to as IoT) connections will be 50% of total devices
- Video will account for 82% of all internet traffic by 2022

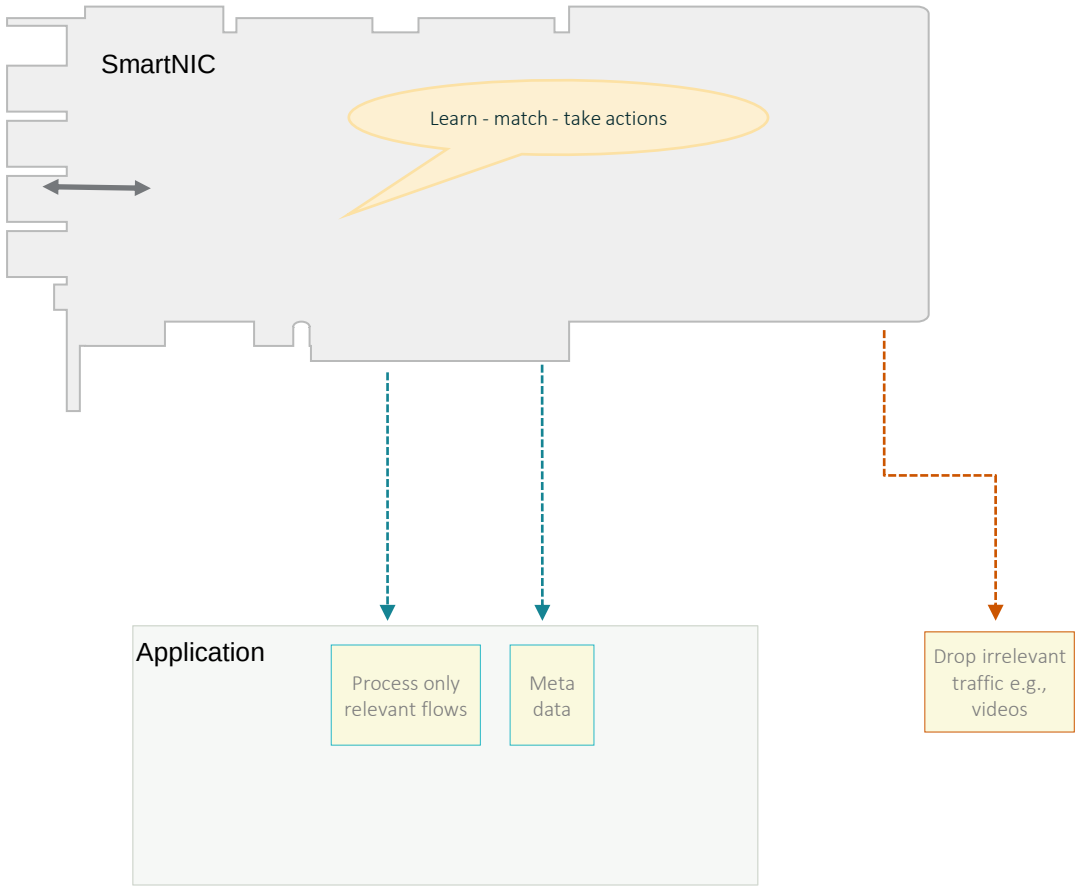
Flow Awareness

Why Flow Awareness Matters

Allows for advanced actions based on flows

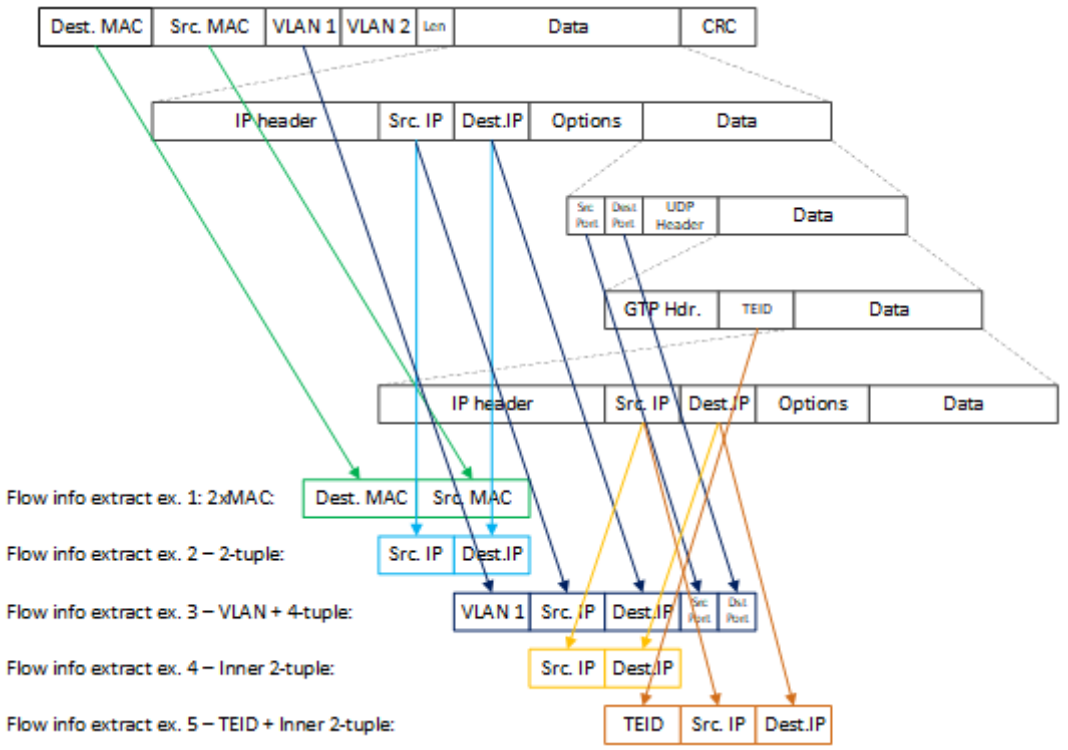
- Network traffic analysis is moving from packet based to flow based
- Most advanced network tools today need to identify flows to be able to apply the correct actions
- Flow awareness becomes a key feature

When a flow has been identified and action(s) has been defined, subsequent packets can be fully offloaded including metrics



Flow Definition

- Napatech flow definition is ultra flexible
  - Any mix of IPv4 and IPv6
  - 2/3/4/5/6-tuples with any header field
  - Support for tunneled flows
  - Unidirectional and bidirectional flows
- Support for multiple flow definitions
  - Depending on category of traffic
- Performance independent of flow definition



Flow Establishment and Termination

- Flow Establishment
  - All flow establishment is handled by the SW application
  - Any packets not matching an existing flow is forwarded to the application
- Flow Termination on termination can be done in 3 ways
  - TCP termination sequence – HW detection
  - Timeout – HW detection
  - Flow deletion – SW action
- Flow info records can be generated upon flow termination
  - Includes meta-data/metrics collected by HW

Tracking / Intercepting data

Flow Awareness enables the possibility to

- Track flows/IP addresses/IMSI numbers/phone numbers
- Intercepting communication to/from/between specific parties on the network
- Block and/or allow specific connections or communication types

Making it possible to intercepting very specific communication

Flow Acceleration / Offloading – Offered by Napatech SmartNICs

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DPI offloading

Decoding of most layer 2, 3 and 4 protocols - provide offsets as meta data to the application

Categorization and Filtering

Categorize packets based on DPI output and extraction of packet data.

Filter out specific data to discard and other specific data to be delivered to specific application threads.

Flow Identification

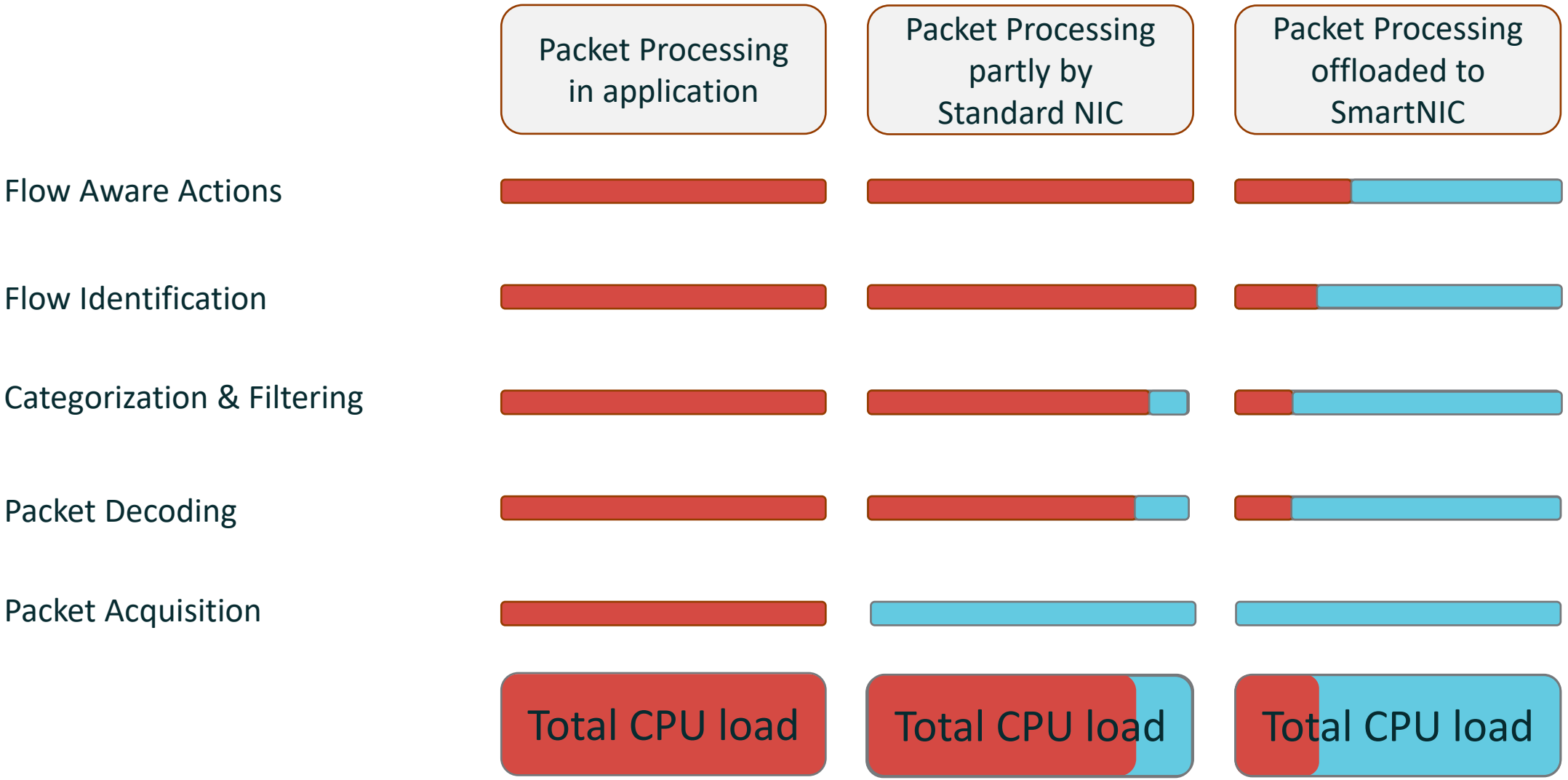
Identify user defined ”flows” based on extraction of packet fields

Flow aware actions

Drop, forward and/or load balance flows based on flow identification

Acceleration and offloading is very important to be able to keep up with the ever-increasing amount of data to process/analyze

Acceleration / Offloading – Offered by Napatech SmartNICs



Link-Capture™ Software
Flow Management - Features

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Flow capacity and learning rate (1)

- 140 million simultaneous bidirectional flows
- Learning/configuration rate: >3 million flows/sec
- Any mix of IPv4 and IPv6

Flow identification

- 2/3/4/5/6-tuple with selectable header fields
- Unidirectional or bidirectional flows
- Flow groups, e.g., IP or MAC address ranges
- 130M lookups per second stateless – 85M for stateful

Match/actions

- Application controlled flow match/action setup
- Multiple actions per packet
- Forward to specific host stream (2)
- Fast forward to port
- Drop
- Update metrics in flow record
- Unmatched packets forwarded to host stream(s)

Flow termination

- TCP flow termination (per flow configuration)
- Timeout (global configuration)
- Application requested

Packet meta data

- Time stamp (1 ns, 10 ns or 1 us)
- L2/L3/L4 offsets, protocol/error info
- Color (for traffic type indication, e.g., GTP-C)
- 64-bit pointer for fast table lookup in application

API

- Native Napatech API (NTAPI)
  - Full feature set
  - Maximum performance
- DKDP – RTE_FLOW (Coming 2022)
  - Standard API
  - Standard feature set
  - Highly accelerated performance

See Napatech.com for more specifications

(1) NT200A02

(2) Related feature: Load distribute over N host streams based on 2/3/4/5/6-tuple hash

Packet fingerprinting – Packet Correlation

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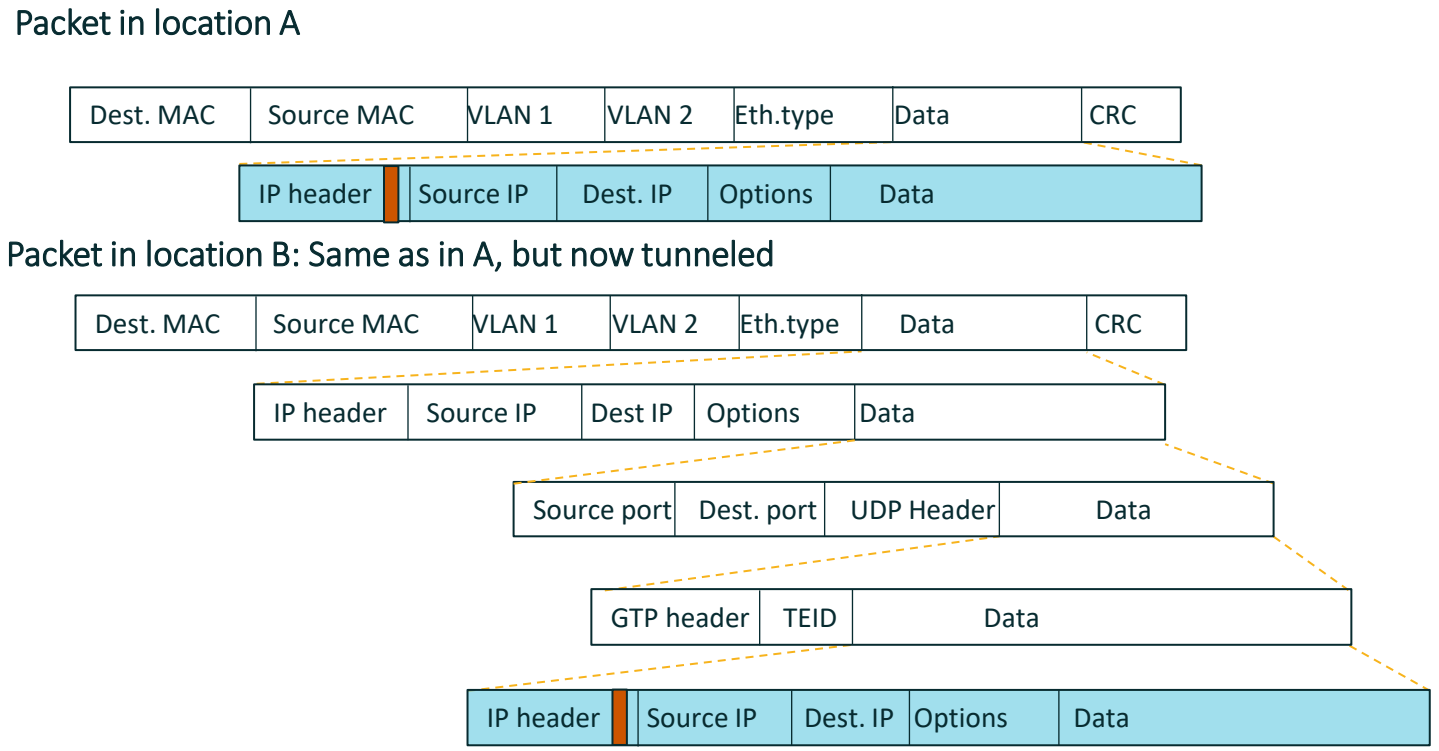
The packet fingerprinting is a way of correlating packets

Examples:

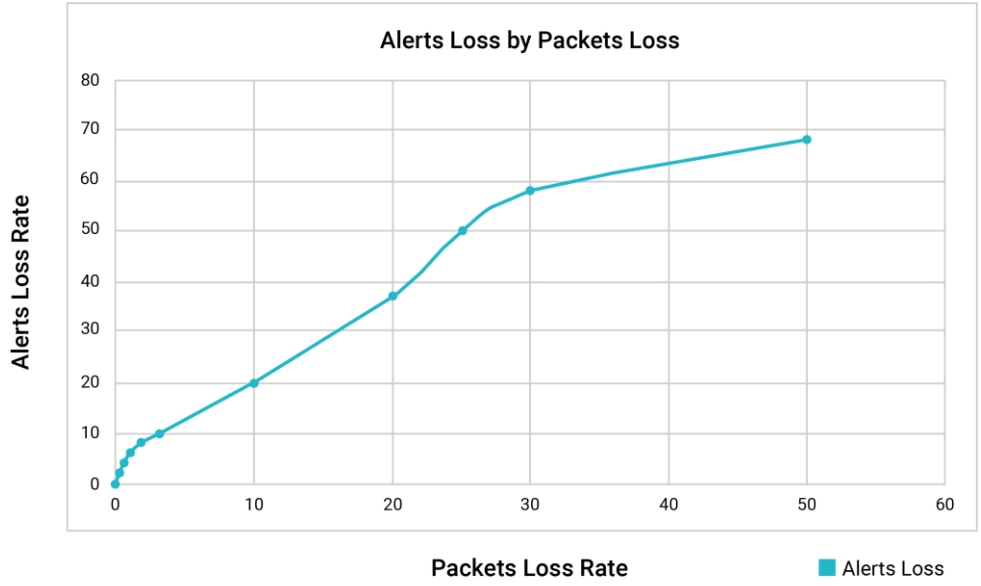
- Finding the ”same” packet in different network locations even if it has been encapsulated or tunneled
- Finding packets with exact same characteristics, like subnets

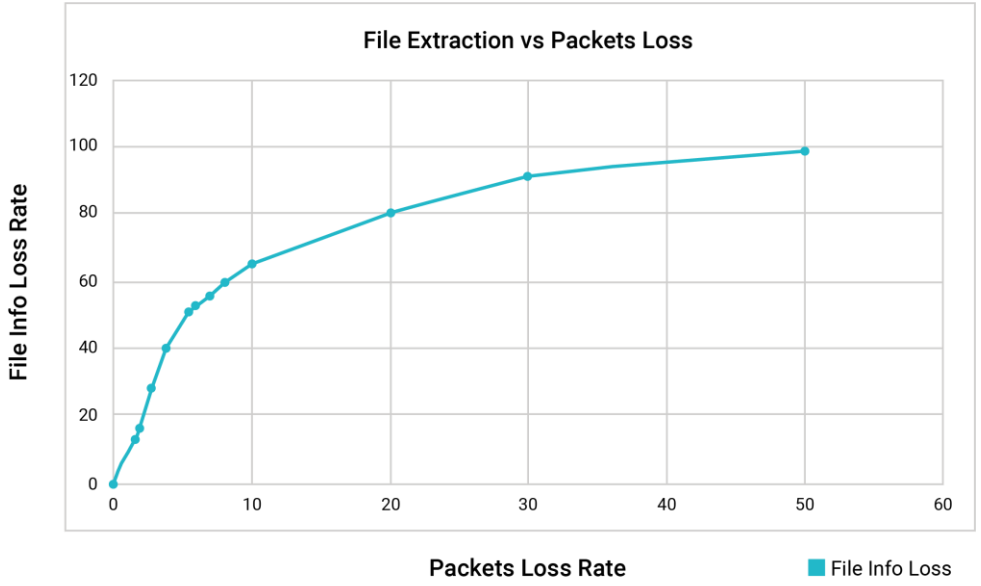


Two very different packets

Identify the two packets to be ”identical” by calculating the packet fingerprint based on outer IP header in location A and on inner IP header in location B – and changing info (e.g., TTL) can be excluded

The Effect of Packet Loss





- 10% missed alerts with 3% packet loss
- 50% missed alerts with 25% packet loss

- 10% failed file extraction with 0.4% packet loss
- 50% failed file extraction with 5.5% packet loss

Napatech support zero-packet loss at full wirespeed

SOURCE: Stamus Networks, SuriCon 2019

We are investigating
- come by the booth to discuss with our experts

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- De-Fragmentation
  - Re-assemble IP datagrams and deliver to the host system and/or forward
- AI/ML acceleration
  - Inline inference engine
- Decryption
  - TLS termination (man-in-the-middle, host offloading)
  - IPSec termination (host offloading)

Summary

Network monitor and analysis applications are challenged

Acceleration and offloading is needed

Flow Awareness is needed

FPGA based SmartNICs can solve your needs
now and in the future

Use Cases

Link-Capture™ Software
Stateful Flow Management – Capture (Monitoring only)

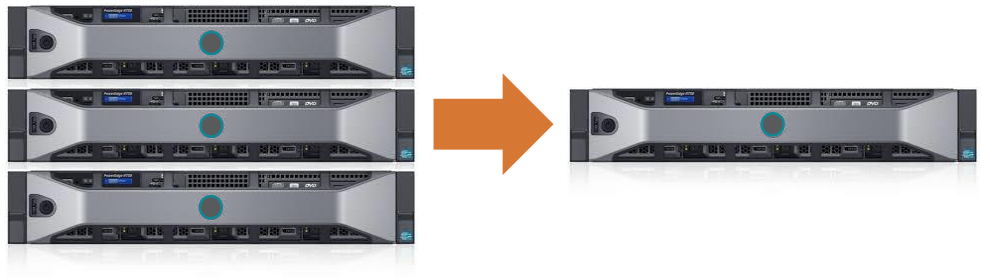
Enables demanding applications to analyze network traffic in single server at 100G link speed

Typical use cases

- Cybersecurity
- Telecom subscriber analytics
- Forensics

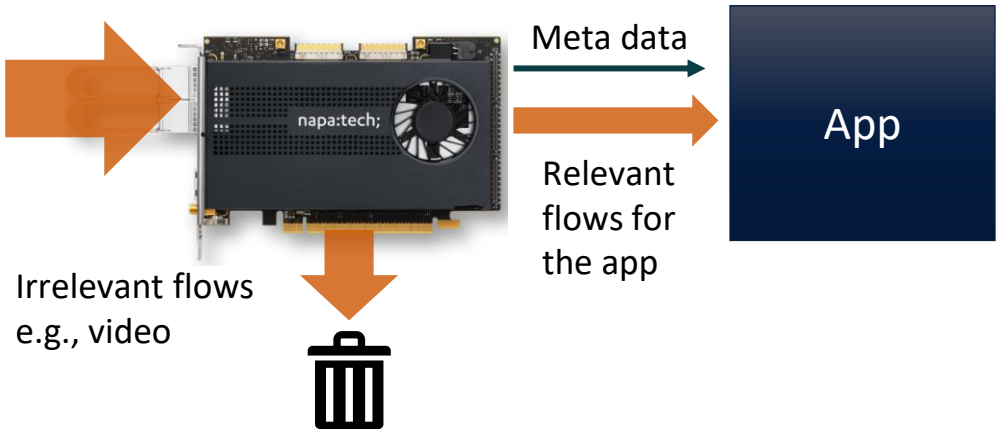
Lower total cost of ownership

- Less servers and lower rack space footprint
- Less power and cooling



Higher performance per server

- Offload application by filtering out irrelevant traffic and flows (typically over 60 percent of traffic on the Internet is video)
- Accelerates application with meta data, such as flow ids for fast table lookup and information for NetFlow records or offsets into packets that have not yet been classified



Link-Inline™ Software
Stateful Flow Management – Inline (fast forward/hairpinning)

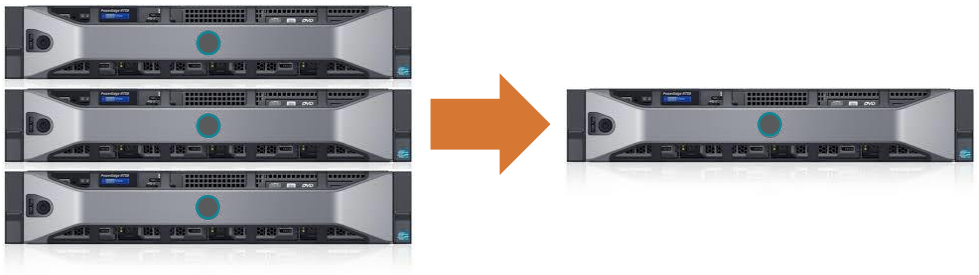
Enables demanding applications to analyze network traffic in single server at 100G link speed

Typical use cases

- Cybersecurity
- Telecom

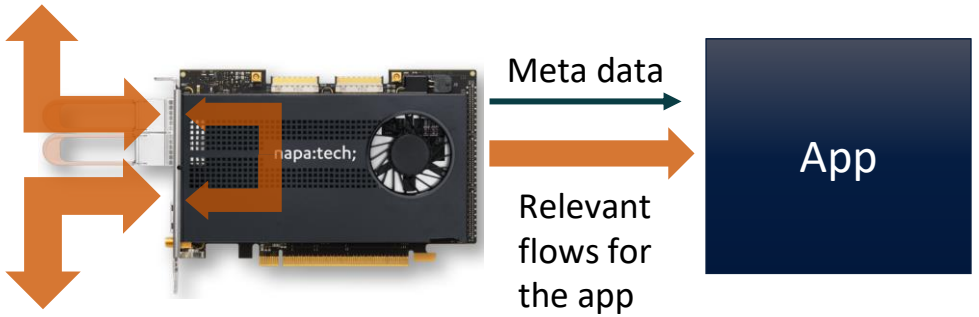
Lower total cost of ownership

- Less servers and lower rack space footprint
- Less power and cooling



Higher performance per server

- **Offload application** by handling flows already classified – typically fast forward (hairpin) or drop
- **Accelerates application** with meta data, such as flow ids for fast table lookup and information for NetFlow records or offsets into packets that have not yet been classified
- Low latency



Our Customers and Partners

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Top Tier Global Customers & Partners

200+ global customers with ~70% of revenue from US-based customers in 2020

Long-term strategic relationships with OEMs & multi-year product design wins

Key partnerships with technology leaders

End-Users across multiple market segments for project design wins

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Thank You!