INTEL® ETHERNET TECHNOLOGY INNOVATIONS

Intel® Ethernet 800 Series with
Application Device Queues (ADQ) &
Dynamic Device Personalization (DDP)

Intel® Ethernet Architecture Evolution

FOUNDATIONAL NICS

Intel® Ethernet
500 Series
Niantic

Intel® Ethernet
700 Series
Fortville

Intel® Ethernet 800 Series
Columbiaville[1]
Announcing

Capability Richness
More
Less

Fixed Pipeline
SR-IOV and VMDq

Partially Programmable Pipeline
- Table definition modifications with a Dynamic Device Personalization (DDP) profile package

Intel® Ethernet Adaptive Virtual Function (Intel AVF)

Queue and Steering Hardware Assists
- Application Device Queues (ADQ)

Fully Programmable Pipeline
- Table definition with DDP profile packages

Storage
- RDMA (iWARP* & RoCE*v2)

10GbE 40GbE 100GbE

[1]Features & schedule are subject to change. All products, computer systems, dates and figures specified are preliminary based on current expectations, and are subject to change without notice.

THE GOAL

MOVE DATA FASTER

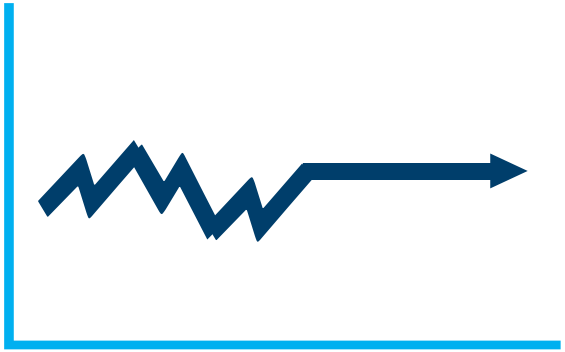
Intel® Ethernet 800 Series Can...

Improve Application Performance with Application Device Queues (ADQ)

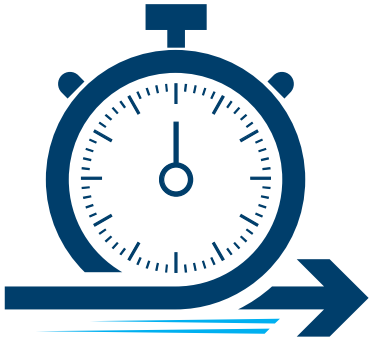
Improve Packet Processing Efficiency with Dynamic Device Personalization (DDP)

Scale-out Application Performance Parameters

PREDICTABILITY



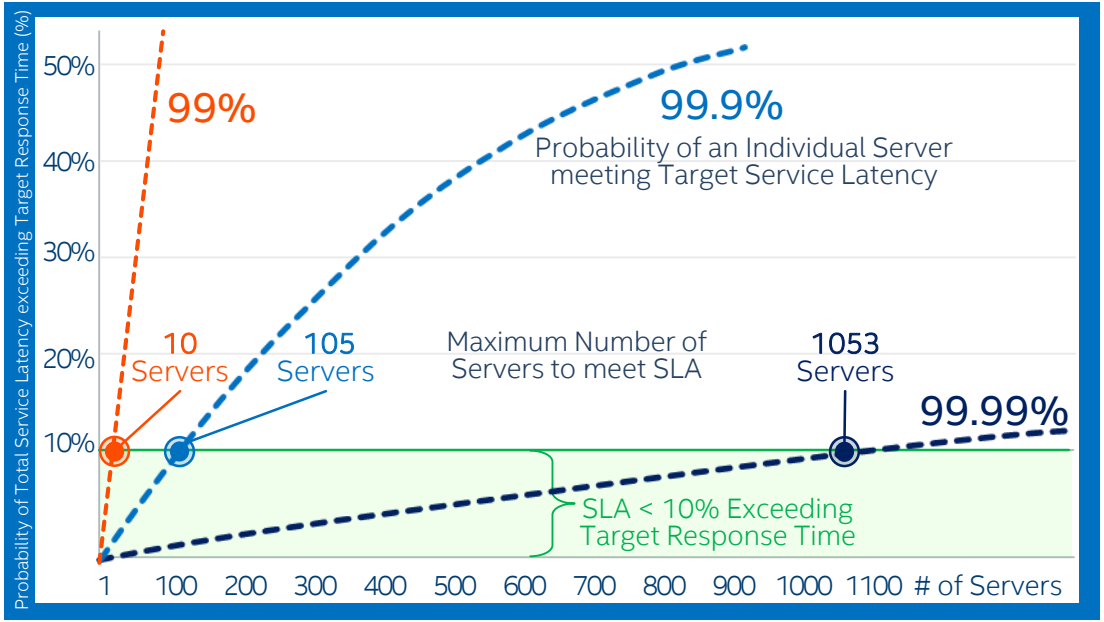
LATENCY



THROUGHPUT

Why Application Response Predictability Matters

Predictability of Data Center Application Performance[1]



"The Tail at Scale" – Communications of the ACM. February 2013
Jeffrey Dean – Google Senior Fellow and Luiz Andrée Barroso – Google Fellow / VP of Engineering
https://cseweb.ucsd.edu/~gmporter/classes/fa17/cse124/post/schedule/p74-dean.pdf

Meeting the Scale-out Challenge

- Reducing variability in application response time (jitter) improves throughput and reduces latency

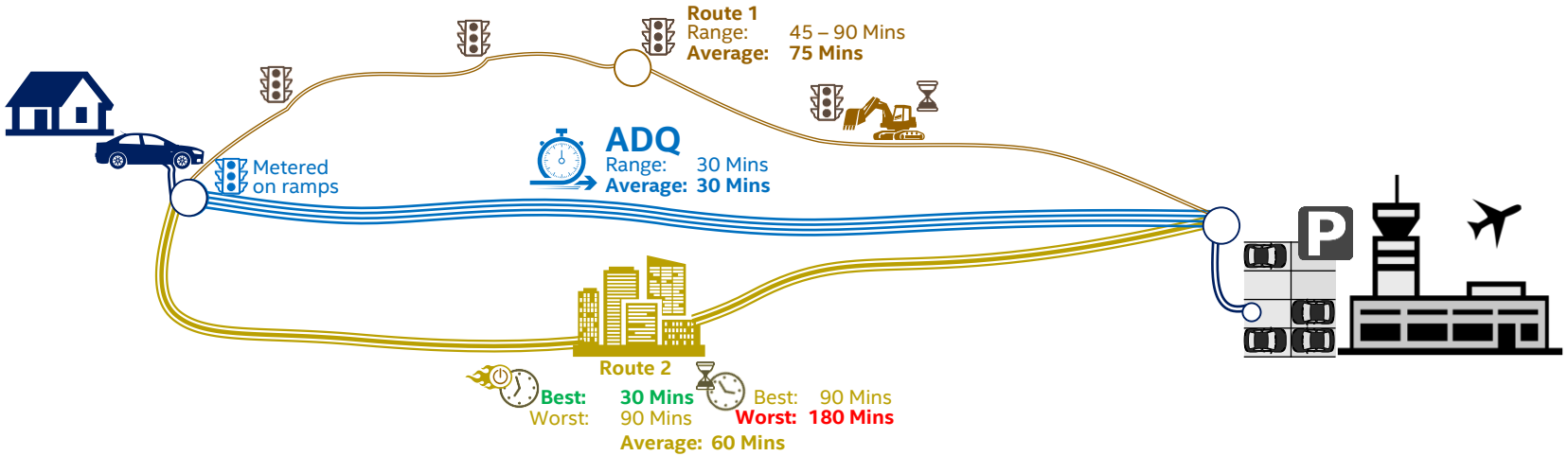
Benefits of Reducing Jitter

- More servers can be added to parallelize task
- Support more end-users with existing hardware

Higher predictability enables more servers working in parallel within a desired response time

How to Improve Predictability

Analogy: Time to Reach Airport for Flight



Application Device Queues (ADQ) Improves Predictability with Dedicated Lanes and Rate Limiting

Intel® Ethernet 800 Series with Application Device Queues (ADQ)

What is ADQ?

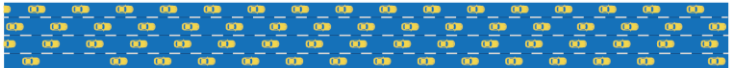
- An application specific queuing and steering technology

How does ADQ work?

- Filters application traffic to a dedicated set of queues
- Application threads of execution are connected to specific queues within the ADQ queue set
- Bandwidth control of application egress (Tx) network traffic

With ADQ

Application traffic to a dedicated set of queues



Without ADQ

Application traffic intermixed with other traffic types

What are the benefits of ADQ?

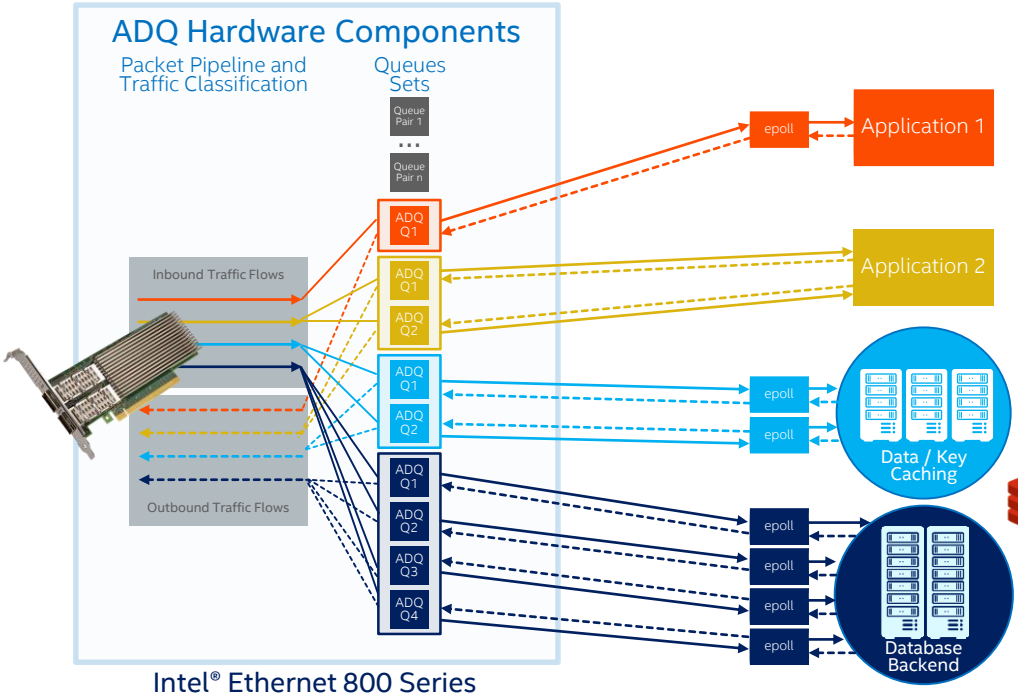
INCREASES APPLICATION **PREDICTABILITY**

REDUCES APPLICATION **LATENCY**

IMPROVES APPLICATION **THROUGHPUT**

Intel® Ethernet -- Application Device Queues (ADQ)[1]

Latest Network Technology Innovation for Intel® Ethernet 800 Series



Intel® Ethernet 800 Series Controllers and Network Adapters

ADQ Basics

- Filters application traffic to a dedicated set of queues
- Application threads of execution are connected to specific queues within the ADQ queue set
- Rate limits application egress (Tx) network traffic

Intel® Ethernet 800 Series with ADQ on Redis Solution Brief

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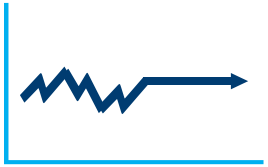
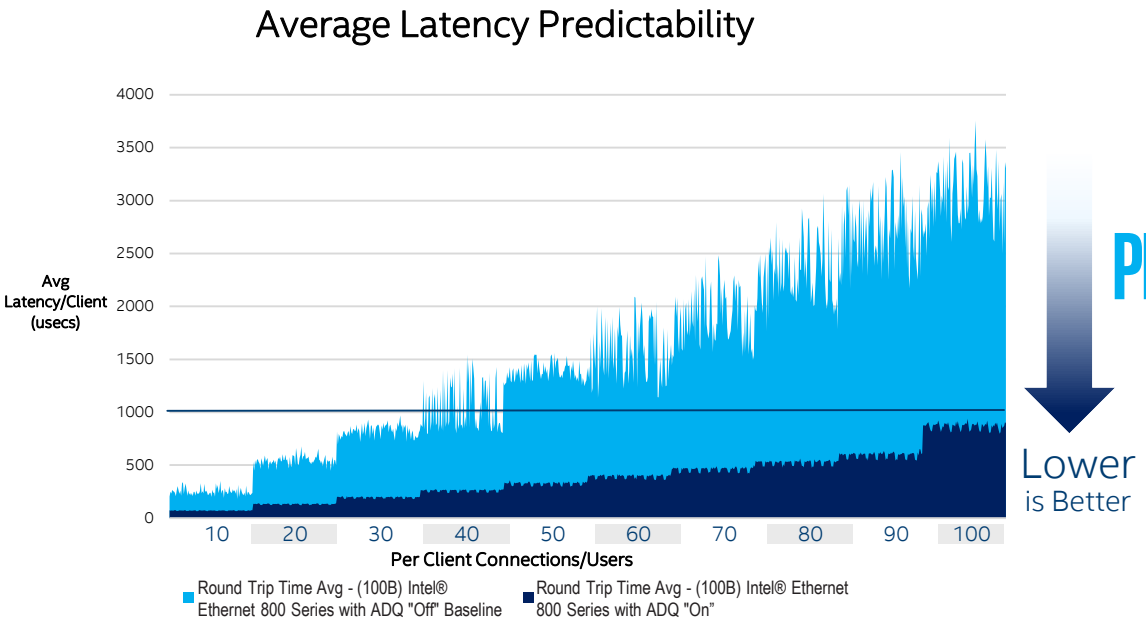
Application Device Queues (ADQ) – Redis* Open Source Database

Performance Results

INCREASES APPLICATION PREDICTABILITY





Lower is Better

>50% PREDICTABILITY INCREASE WITH OPEN SOURCE REDIS

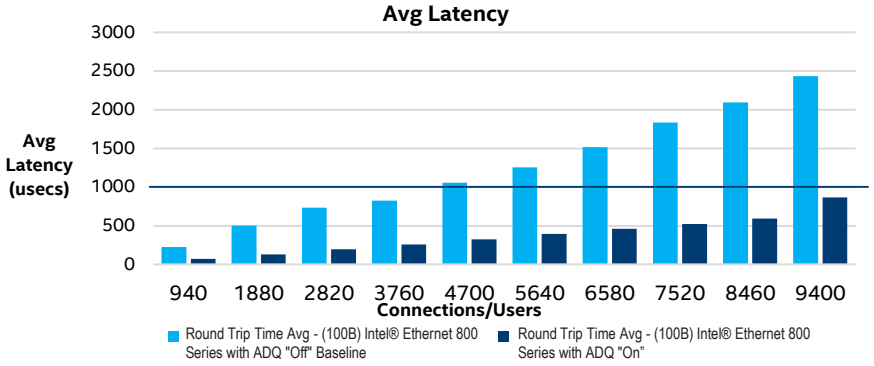
redis*

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit http://www.intel.com/performance. Source: Performance results are based on Intel internal testing as of February 2019, and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure. Tests performed using Redis Open Source on 2nd Generation Intel® Xeon® Scalable processors and Intel® Ethernet 800 series 100GbE on Linux 4.19.18 kernel (see backup) Calculation: (new - old) / old x 100% for reduction in variance of Standard Deviation of Rtt Average Latency across all runs (10 to 100) for baseline vs ADQ (229-739)/739 * 100% = -69% Reduction in Variance

Application Device Queues (ADQ) – Redis* Open Source Database

Performance Results

REDUCES APPLICATION LATENCY

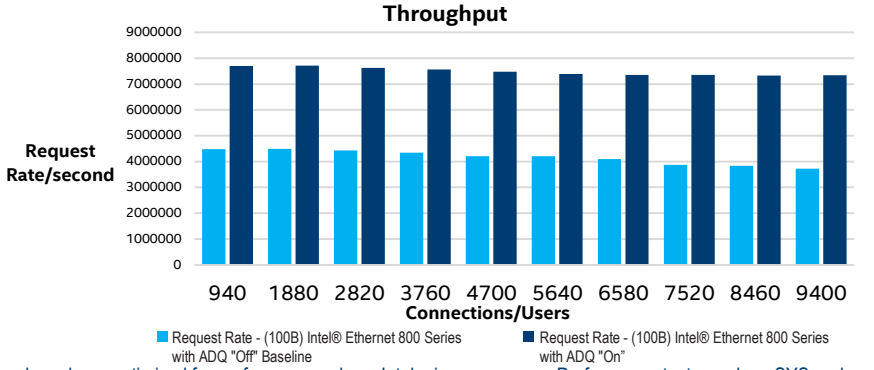


Lower is Better

>45% LATENCY REDUCTION WITH OPEN SOURCE REDIS

redis*

IMPROVES APPLICATION THROUGHPUT



Higher is Better

>30% THROUGHPUT IMPROVEMENT WITH OPEN SOURCE REDIS

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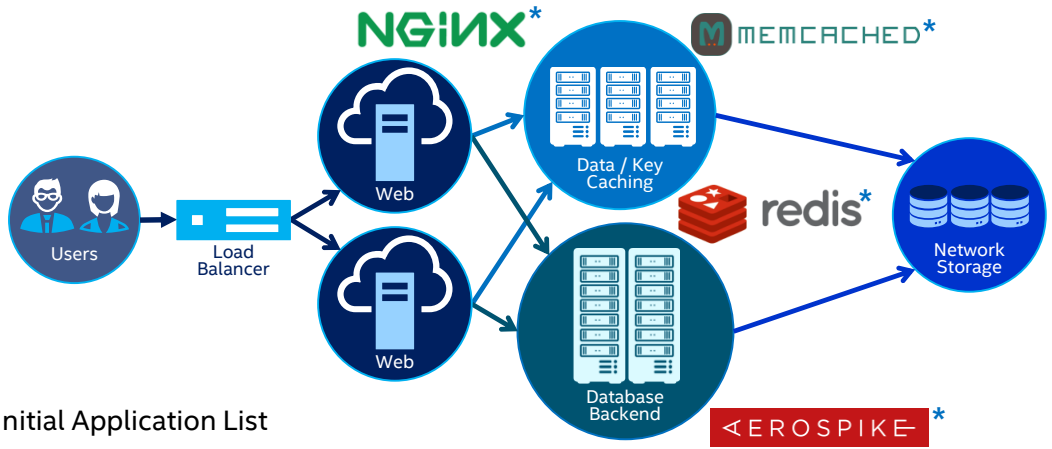
Application Device Queues (ADQ)[1]

Performance Improvements across Multiple Tiers



Initial Application List

NGINX

"NGINX is excited to collaborate with Intel on delivering a significant reduction in latency. Together we help to scale NGINX based cloud services with the new Intel® Ethernet 800 Series with Application Device Queues"

Christine Puccio VP, Global Strategic Alliances & Partnerships

AEROSPIKE

"Getting useful insights in real-time out of Big Data comes with a set of major challenges such as predictable low latency and maximum throughput at the network layer. Aerospike, as always, is at the forefront of addressing these challenges. We expect the Intel® Ethernet 800 Series with Application Device Queues (ADQ) coupled with Aerospike Enterprise will help get predictable performance, higher data throughput and lower latency. We are pleased to work closely with Intel to bring this exciting new technology to our customers."

Srini Srinivasan, Founder and Chief Product Officer

Significantly Improves Predictability, Latency and Throughput

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Intel® Ethernet 800 Series Does...

MOVE DATA FASTER

Improve Application Performance with Application Device Queues (ADQ)

Improve Packet Processing Efficiency with Dynamic Device Personalization (DDP)

Changing Network Landscapes – Changes Protocol Needs

Significant expansion of protocol types that network adapters need to parse

ENTERPRISE

Network Virtualization over Layer 3 (NVO3)

Virtual Extensible LAN (VXLAN) [RFC7348]

Generic Protocol Extension for VXLAN (VXLAN-GPE)

Network Virtualization using Generic Routing Encapsulation (NVGRE) [RFC7637]

Generic Network Virtualization Encapsulation (GENEVE)

Network Service Header (NSH)

SERVICE PROVIDERS

C-VLAN Tag (C-Tag)

Customer VLAN (C-VLAN)

S-VLAN tag (S-Tag)

Service VLAN (S-VLAN)

Customized Protocols

NETWORK EDGE

GPRS Tunneling Protocol (GTP)

Internet Protocol over Ethernet (IPoE)

Layer 2 Tunneling Protocol (L2TP)

Multiprotocol Label Switching (MPLS)

Multi-Service BNG (MS-BNG)

Residential Gateway (RG)

Point to Point Protocol (PPP)

PPP over Ethernet (PPPoE)

Control and Provisioning of Wireless Access Points (CAPWAP)

SECURITY

Internet Protocol Security (IPsec)

Encapsulating Security Payloads (ESP)

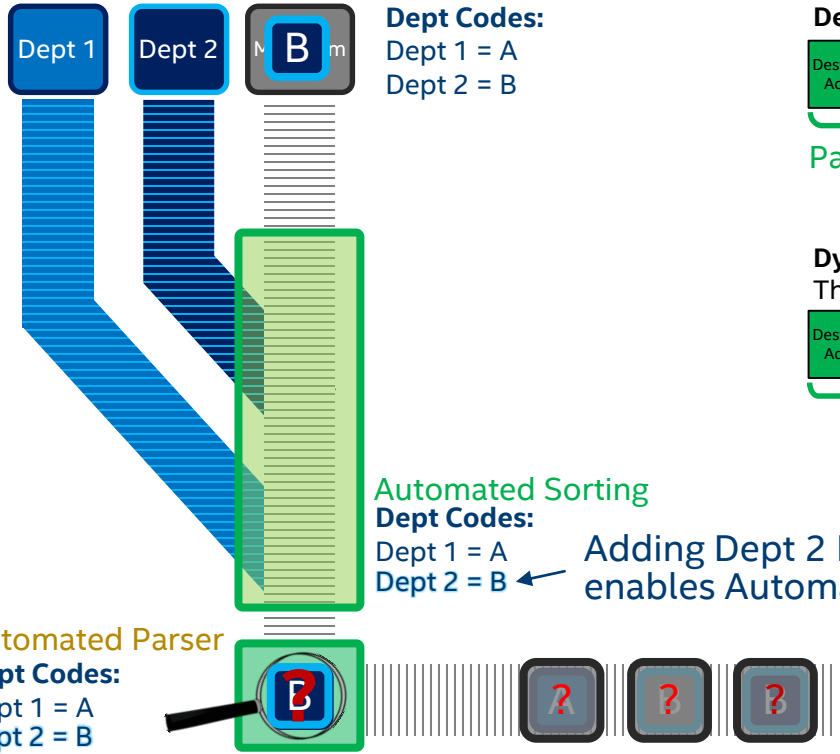
Authentication Headers (AH)

Security Associations (SA)

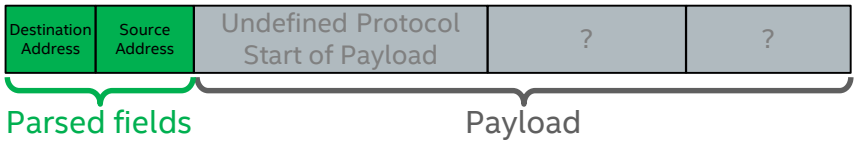
DEFAULT PROTOCOL SUPPORT + PROGRAMMABLE TO MEET SEGMENT NEEDS

Why a Programmable Pipeline Matters

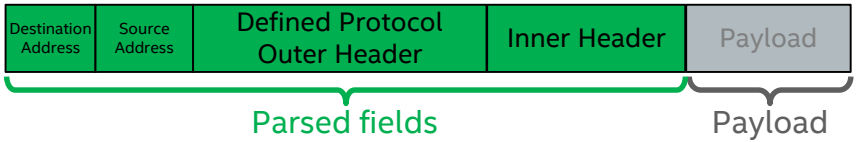
Analogy: Conveyer Belt Package Deliver



Default pipeline relies on host to parse undefined protocols



Dynamic Device Personalization (DDP) Profile enabled
The pipeline parser can look deeper in to the packets



Dynamic Device Personalization (DDP)

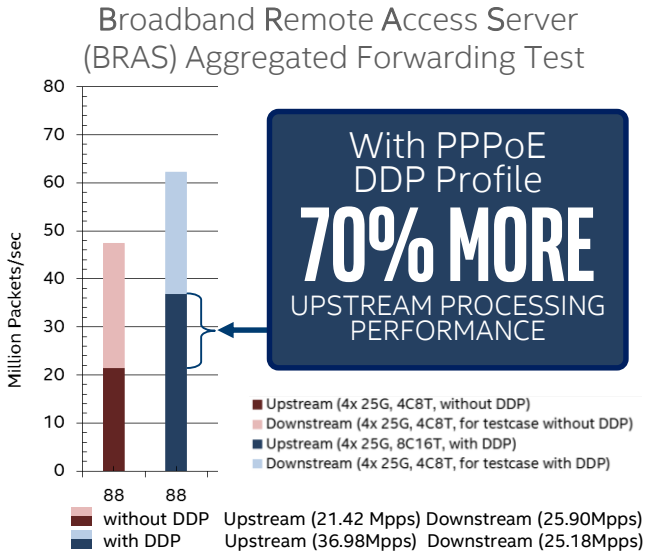
Intel® Ethernet 700 Series and Intel® Ethernet 800 Series[1]

RUN-TIME PROGRAMMABILITY

Packet pipeline customization to meet a wide range of customer deployment needs

OPTIMIZE PERFORMANCE

- Lower Latency
- Higher Throughput
- Improved CPU Utilization



Customer Example: http://www.prweb.com/releases/qct_launches_next_generation_central_office_solutions/prweb16053614.htm

AVAILABLE NOW

Intel® Ethernet 700 Series DDP Profiles

Publicly Released: GTPv1, PPPoE

Others: MPLSoGRE/MPLSoUDP, L2TPv3, QUIC, IPv4 Multicast, 4G Fronthaul, eCPRI, VXLAN-GPE, IPsec

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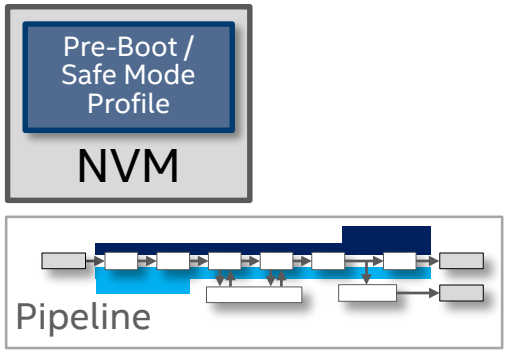
Source: Intel internal testing as of November 2017. [1] Features & schedule are subject to change. Calculation: Upstream DDP vs w/o DDP ((36.98-21.42)/21.42*100%) = 72.6%

Intel® Ethernet 800 Series with Programmable Pipeline via Dynamic Device Personalization (DDP) Profiles[1]

Pre-Boot / Safe Mode

NEW

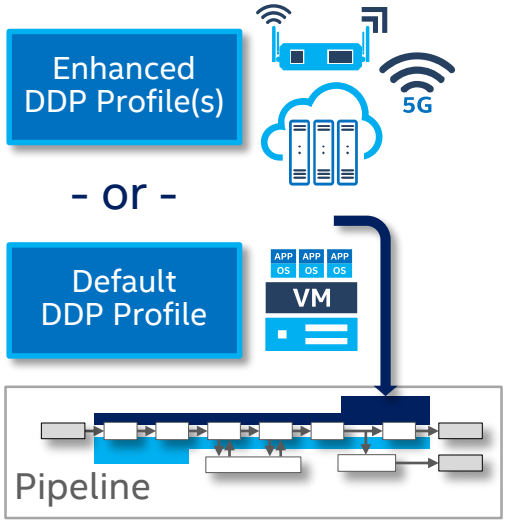
Profile included in NVM
Firmware Controls Configuration



OS Boot

NEW

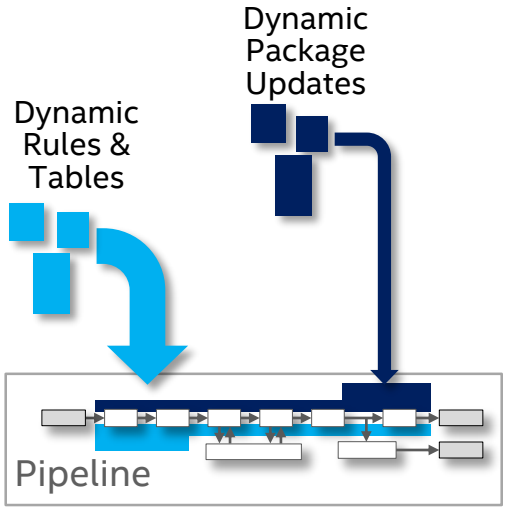
Device Driver Loads and Controls Configuration



Runtime

IMPROVED

Standard OS or DPDK Configuration Tools



Improves Packet Processing Efficiency and Dynamic Workload Optimization

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Intel® Ethernet 800 Series Delivers...

MOVE DATA FASTER

Improve Application Performance
with Application Device Queues (ADQ)

Improve Packet Processing Efficiency
with Dynamic Device Personalization (DDP)

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