

ACM ICN 2020

Multi-Worker NFD : an NFD-compatible High Speed NDN Forwarder

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Motivation

- ▶ **NDN Forwarding Daemon (NFD)**
 - ▶ is a default NDN forwarder
 - ▶ is designed for **modularity and feature extensibility**
 - ▶ but has **low forwarding performance**

- ▶ **Main bottleneck of NFD performance**
 - ▶ **Single-Thread Forwarding Architecture**

Multi-Worker NFD (MW-NFD)

▶ Design Goals

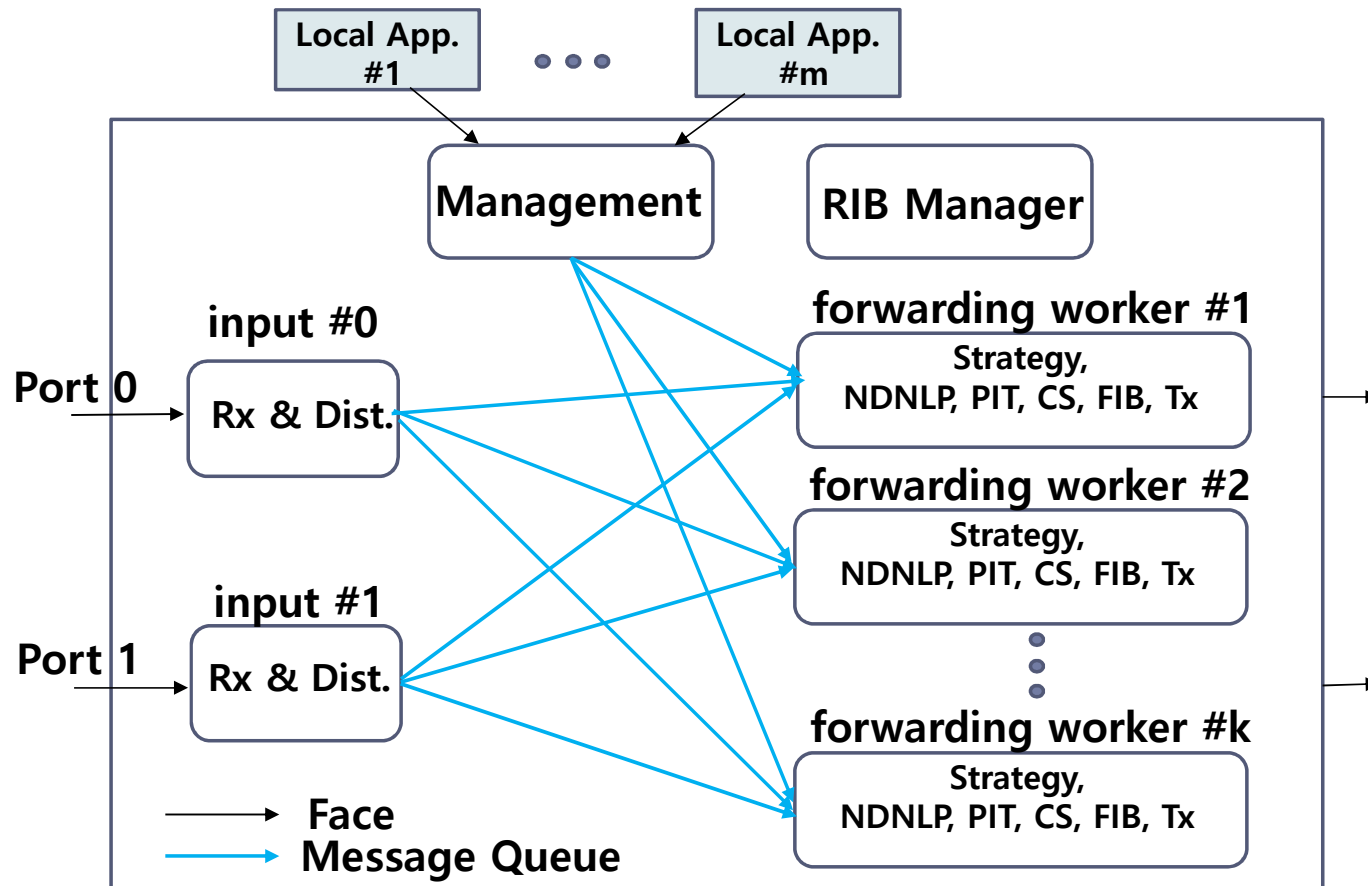
- ▶ High-speed NDN Forwarding
- ▶ Full compatibility with NFD and existing NDN applications
- ▶ Keep NFD's Forwarding Plane Architecture for easy porting of any new NFD features

▶ Design Principles

- ▶ Support multiple forwarding threads running on different cores
- ▶ Keep NFD's forwarding plane in forwarding threads
- ▶ Support all the management features of NFD with same API

▶ Based on NFD v0.7.0

MW-NFD Architecture



Input Threads

- ▶ Allocate **one input thread to each input port**
- ▶ Receive packets from faces associated to the port
 - ▶ register **associated faces to the thread's io_service**
- ▶ Packet parsing and distribution to workers based on
 - ▶ Interest *
 - ▶ **hash of name prefix of pre-configured length (default = 2)**
 - ▶ Data/Nack without PIT token *
 - ▶ same to Interest
 - ▶ Data/Nack with PIT token *
 - ▶ **worker-id of matching Interest encoded in PIT token**
 - ▶ First fragment Interest/Data/Nack
 - ▶ same to Interest/Data/Nack
 - ▶ store selected worker-id with its `fragment_index`
 - ▶ Subsequent fragments :
 - ▶ stored worker-id for its `fragment_index`

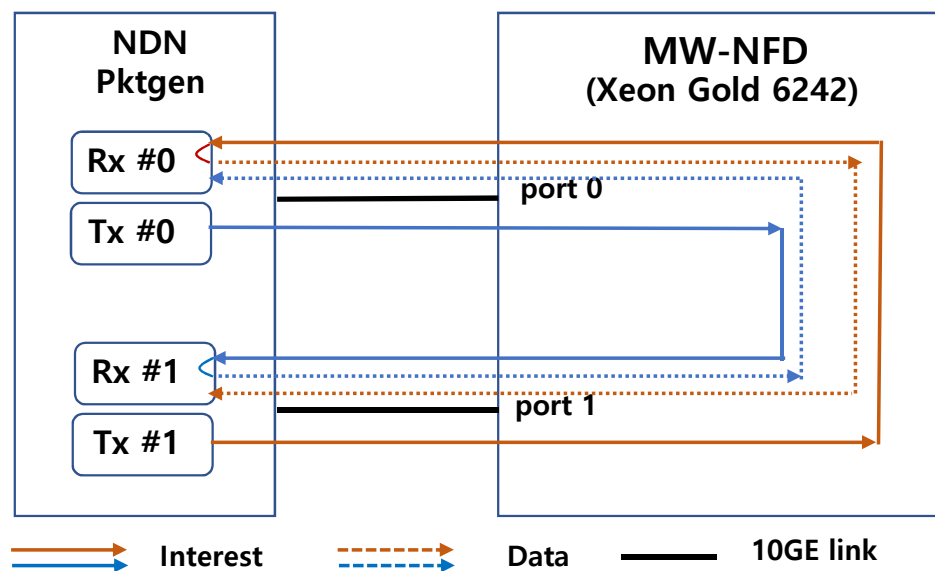
(*) : adopted from NDN-DPDK

Management Thread

- ▶ Launches input and forwarding worker threads on configured cpu cores
- ▶ Receives and distributes packets from local application faces and internal face
- ▶ Processing all management commands (nfdc commands) by interacting with input and worker threads
 - ▶ under development

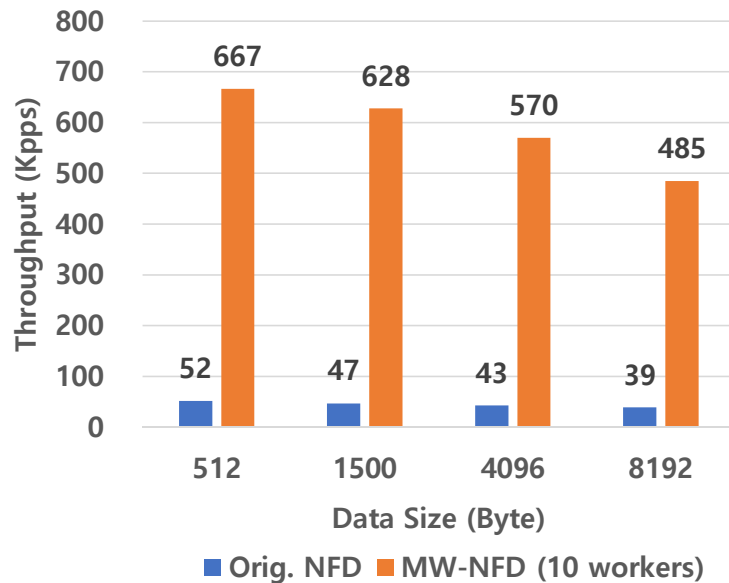
Forwarding Demo Configuration

- ▶ NDN Pktgen : based on DPDK pktgen 19.12
- ▶ FIB : 10K (avg prefix length = 4.26)
- ▶ Interest Stream : 10M with unique names (adding 2~4 words to FIB entries)
- ▶ Platform
 - ▶ MW-NFD : Xeon Gold 6242 (2.8GHz, 16 cores) with two 10GE ports NIC

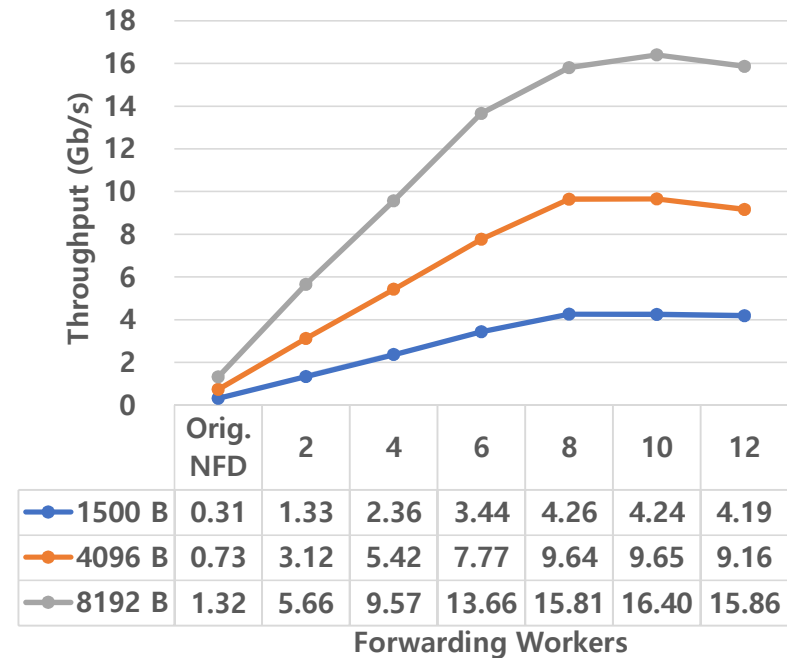


Forwarding Throughput

- ▶ Interest + Data Forwarding Throughput
- ▶ **16.4 Gbps** (for 10 workers, 8192 B Data)
- ▶ MW-NFD can yields **about 13 times of NFD** throughput



Forwarding Throughput (Kpps)



Forwarding Throughput (Gb/s)

Future Work

- ▶ Develop **management features** fully compatible with NFD
 - ▶ nfdc command processing
- ▶ **Compatibility tests** with existing NDN applications
- ▶ Enhancing some forwarding logic implementations
 - ▶ Packet receiving in input threads
 - ▶ some NFD forwarding logics (CS lookup/insert, etc)
- ▶ **Source release after compatibility testing**