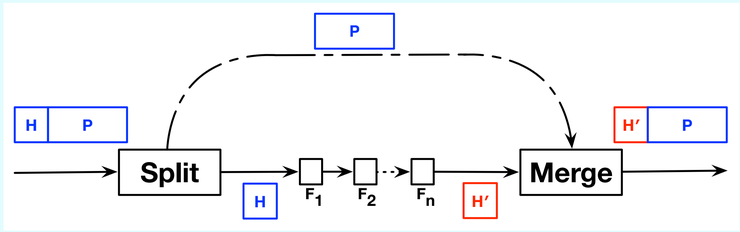
Cutting Packet Fat in Shallow VNF Chain Processing

Problem

- Datacenter operators strive to simultaneously provide performance guarantees and optimize resource utilization
- Clients want minimal end-to-end latency for VNF chain processing

SMP Overview



Shallow VNFs Observation

- Some VNFs process only packet header (shallow VNFs)
- We can save bandwidth by not transmitting payload to such VNFs
- Less Tx/Rx of data will reduce overall packet processing latency

Proposal: SMP

Split-Merge* Payload *(SMP) approach will:

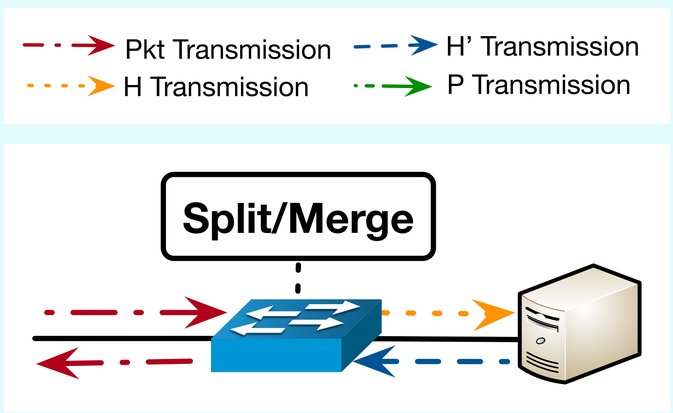
- Split packet into header H and payload P [1]
- Forward header H to the VNF chain F_1, F_2 ... F_n
- Merge the output header H' with payload P

SMP Semantics

SMP and non-SMP deployments will:

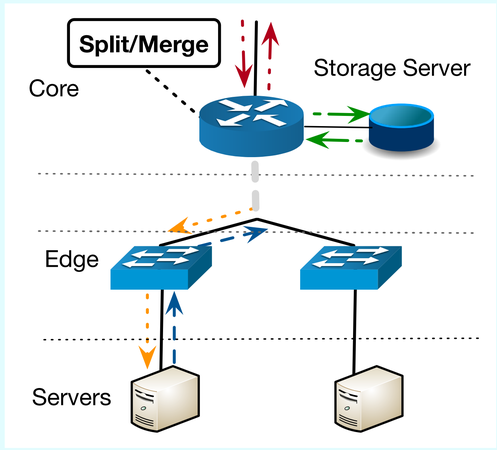
- Preserve VNF topology
- Treat policy-driven and failure-driven packet drops identically

ToR Deployment



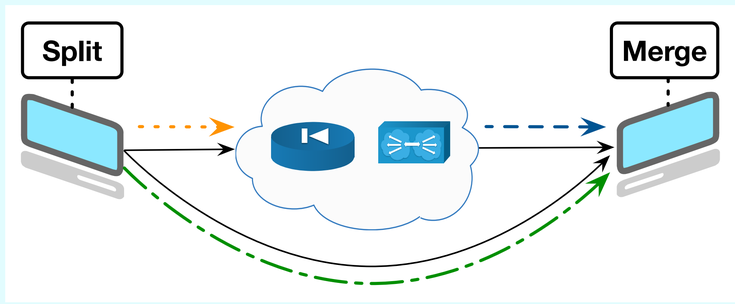
+ SMP operation is transparent to user
+ Lowest memory pressure at ToR switch
+ Can handle payload processing VNFs
- Lowest throughput and latency gain
- Same payload privacy as non-SMP

Core Switch Deployment



+ SMP operation is transparent to user.
+ Higher throughput and latency gain
+ Can handle payload processing VNFs
- Same payload privacy as non-SMP
- Memory pressure requires external store

End-host Deployment



+ Least payload overhead on cloud
+ Highest throughput and latency gain
+ Best privacy for user data
- SMP operation is not transparent to user
- Cannot handle payload processing VNFs

Design Goals

- Equivalent semantics between SMP and non-SMP deployment
- Design should work within the memory constraints of the SMP switch [2]
- Better latency & throughput of SMP deployment than non-SMP

Research Questions

- Can SMP be extended to include payload processing VNFs?
- Can we generalize SMP to process only a subset of the payload [3]?
- At what point will split/merge overhead impede overall packet processing?

[1] Cheng, P. et al. Catch the Whole Lot in an Action: Rapid Precise Packet Loss Notification in Data Center. In NSDI 2014

[2] Jin, X. et al. NetCache: Balancing key-value stores with fast in-network caching. In SOSP 2017

[3] Fernandes S. et al. Slimming down deep packet inspection systems. In IEEE INFOCOM Workshops 2009

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