VNF Chain Abstraction for Cloud Service Providers

Tenant and cloud provider needs

- Tenants: elastic VNF chains with SLA guarantees
- Cloud providers: scalable + high utilization VNF chain deployment

Prior work: elasticity at different granularities

- APLOMB [1], E2 [2], OpenBox [3] scale up/down an individual VNF
- Flurries [4] operates at flow-level: separate chain per flow
- We provide a middle ground between these approaches:
  - flexible flow-processing with low-overhead

Our approach: abstract-concrete chains

- Decouple tenant’s view of the VNF chain (abstract) from cloud provider’s implementation (concrete)
- Decoupling granularity is dynamically set by the provider
- Fine-grained chains enable aggregation across physical resources and increases data center utilization

Challenges

- State synchronization btw. concrete chains
- Low latency across concrete chains
- Handling packet-loss during scale down
- Efficiency loss due to 1-n chain replication

Prototype

- Uses Mininet, OVS, and Docker
- Run Daisy on an Azure VM with 64 cores and 432 GB RAM
- Emulated rack-scale DC with 40-server

Preliminary results

- An abstract chain is decoupled into 75 concrete chains
- 10 Mbps traffic is pushed through each concrete chain
- In aggregate, 75 concrete chains achieve full DC utilization

Prototype

- Performed chain scale-out with no packet drops
- Also completed node-upgrade with under 1s packet drop [5]

[4] Zhang et al., Flurries: Countless Fine-Grained NFs for Flexible Per-Flow Customization, CoNEXT’16
[5] Kodirov et al., VNF Chain Allocation and Management at Data Center Scale, ANCS’18