Research Directions in Network Service Chaining

Wolfgang John, Konstantinos Pentikousis, George Agapiou, Eduardo Jacob, Mario Kind, Antonio Manzalini, Fulvio Risso, Dimitri Staessens, Rebecca Steinert, Catalin Meirosu
Today Network Service Chaining

Today's service model

Access NODE

Sec GW
DPI
FW

Aggregation

IP Edge

Core

DataCenter

Home/Enterprise network

CPE
Dynamic Network Service Chaining is a carrier-grade process for continuous delivery of services based on network function associations.
Challenge 1:
NSC Description and Programming
• Describing Services
  – Which services have to be deployed?
    • Characteristics, parameters
• Programming the whole network chain
  – How can we chain the services together?
    • Highly descriptive languages?
    • Simple RESTful API?
• Programming network flows
  – Which traffic has to cross each block?
  – OpenFlow?
• Network monitoring and debugging
  – How we can debug a service chain under live operations?
Challenge 2: Service Instance Deployment
Universal node paradigm?

• Standard high-volume hardware
  – Enables transparent deployment of functions across network + data center
  – Need for some network-oriented component for data-plane speedup?

Is there an optimal mix?

Forwarding efficiency

Service features

Heterogeneous network with dedicated hardware

Generic x86 hardware only
Modularity and optimality of functions

• Modular design of network functions?
  – Functions could be split in sub-functions and instantiated in different (optimized) locations

• How to map service chains to available resources?
  – Heuristics?
Challenge 3: Continuous Network Service Delivery
How to introduce/deploy/modify NSC...

... without extensive field trials?

SP-Dev-Ops
How to guarantee the correctness of the service chain? (1)

Intelligent, continuous model checking
How to guarantee the correctness of the service chain? (2)
How to monitor the service chain?

Programmable observation points
Define basic observation constructs

Scalable, granular observability
Challenge 4: Security
• Cross-domain issues
  – Service belongs to the Network Operator domain, while users are in another domain
  – Mobile users

• Short-lived network services
  – Mobile users
  – Additional network services activated upon some events (e.g., user starts playing an online game)

• Fast cross-domain authentication
The UNIFY vision

Service related functionality

Flexible Service Programmability

Distribution of service functionality

From home networks up to data centre: “unified production environment”