The (Multiple) Connection between ALTO and SDN

Telefónica

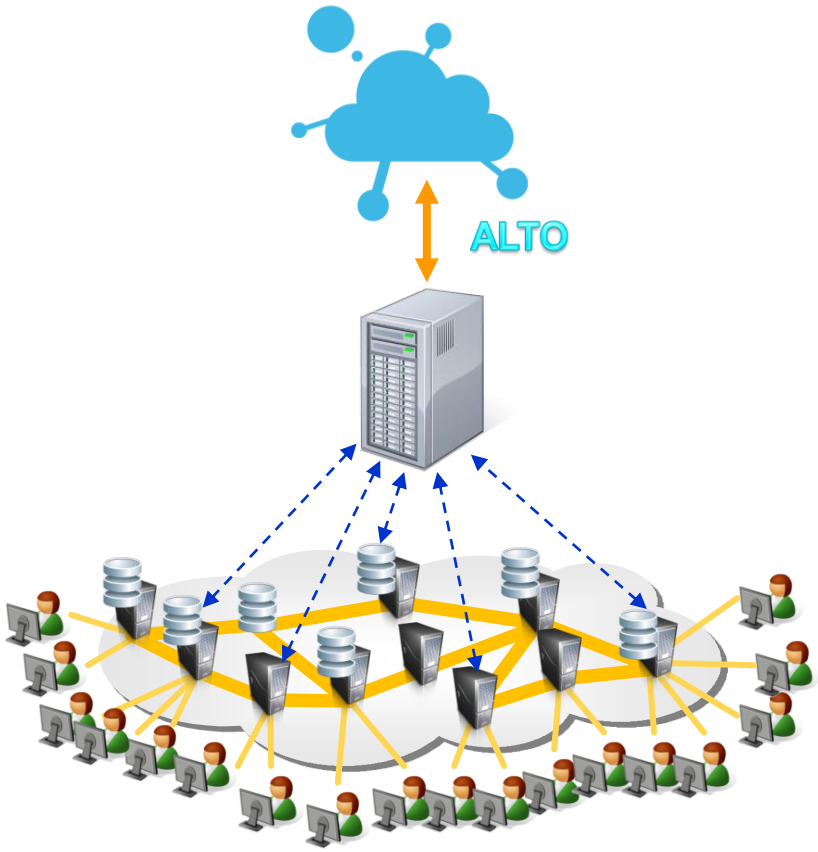
Telefónica
I+D
25.10.2012

The What

- Application-Layer Traffic Optimization
- A mechanism for providing information on the network
  - To modify the patterns of network resource consumption
  - And maintain or even improve performance
- Based on abstract networks maps
  - And properties associated with those maps
  - Associated with costs
- Maps are based on PIDs
  - Provider-defined Network Location identifier
  - General, network-agnostic, identifying a set of related endpoints
- An IETF WG defining these mechanisms and the current ALTO protocol
  - RESTful interface
  - JSON syntax
- P2P and CDN as initial use cases
- Extensible by design
- Sounds like a natural support for SDN

The How

- An ALTO server collects data on topology
  - And, to some extent, state
  - No real-time service
- Aggregates data and builds the maps
  - According to provider policy
  - Privacy
  - Confidentiality
  - Network intelligence
  - No single view required
- The servers publishes the available endpoints
- Clients attach to the endpoints and collect the maps



The Looks

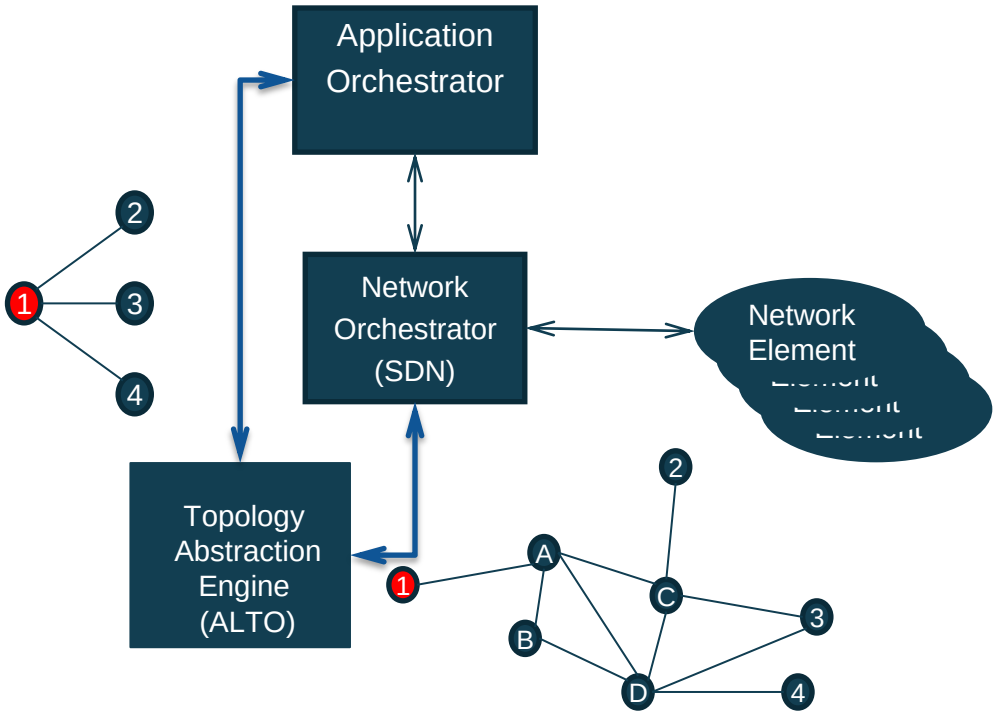
- Simple JSON syntax for requests and responses
- Maps contain PIDs and the endpoints they group
- Cost maps contain relationships between PIDs
- Clients make explicit requests for particular maps
  - Or properties of specific combinations of PIDs
- JSON makes data easily extensible and suitable for integrating them with additional sources
  - Much more flexible than current signalling protocols

```
"data":{
  "map-vtag":"1266506139",
  "map":{
    "mypid1":{
      "ipv4":["10.0.0.0/8","15.0.0.0/8"]},
    "transitpid1":{
      "ipv4":["132.0.0.0/16"]},
. . .
    "defaultpid":{
      "ipv4":["0.0.0.0/0"],
      "ipv6":["::/0"]}
  }
}
```

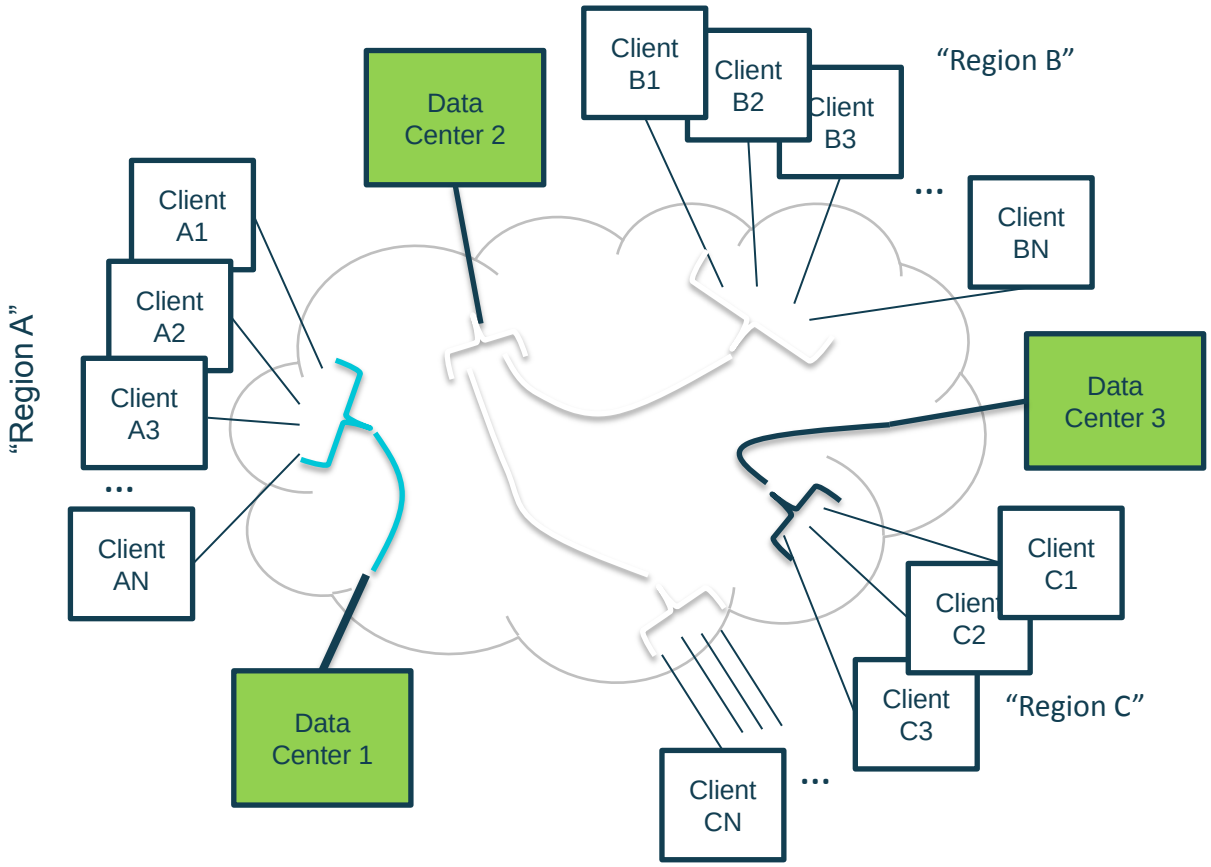
```
 "data" : {
   "cost-mode" : "ordinal",
   "cost-type" : "routingcost",
   "map-vtag"  : "1266506139",
   "map" : {
     "mypid1":{
       "mypid1":0, "mypid2":0, "mypid3":0,
       "peeringpid1":1, "peerinpid2":1,
       "transitpid1":4, "transitpid2":4,
       "defaultpid":5},
     }
. . .
   }
}
```

The (Not So) Obvious: One-to-One

- Co-locate ALTO servers and SDN controllers
- The SDN controller is an excellent source for the ALTO server
  - The only one, if full SDN is achieved
  - A relevant aggregator otherwise
  - An open update protocol would be of great help
- The SDN controller takes advantage of the ALTO server
  - ALTO becomes the standard mechanisms for retrieving certain networks properties
  - And combine then with application state and requirements
  - Especially in mixed environments
- Achieving Cross-Stratum Orchestration
- ALTO as part of the Northbound API

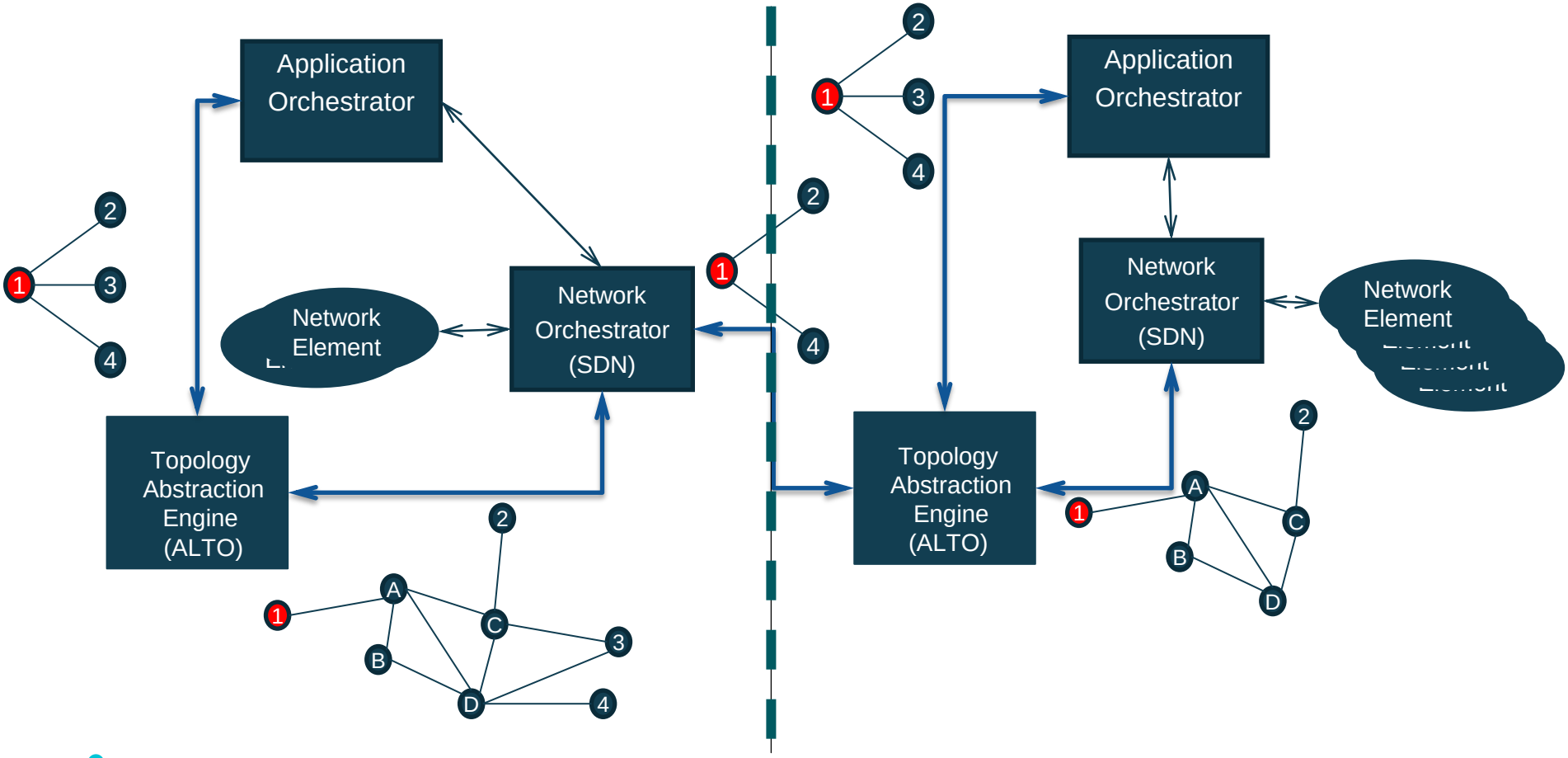


CSO-based Express Lanes



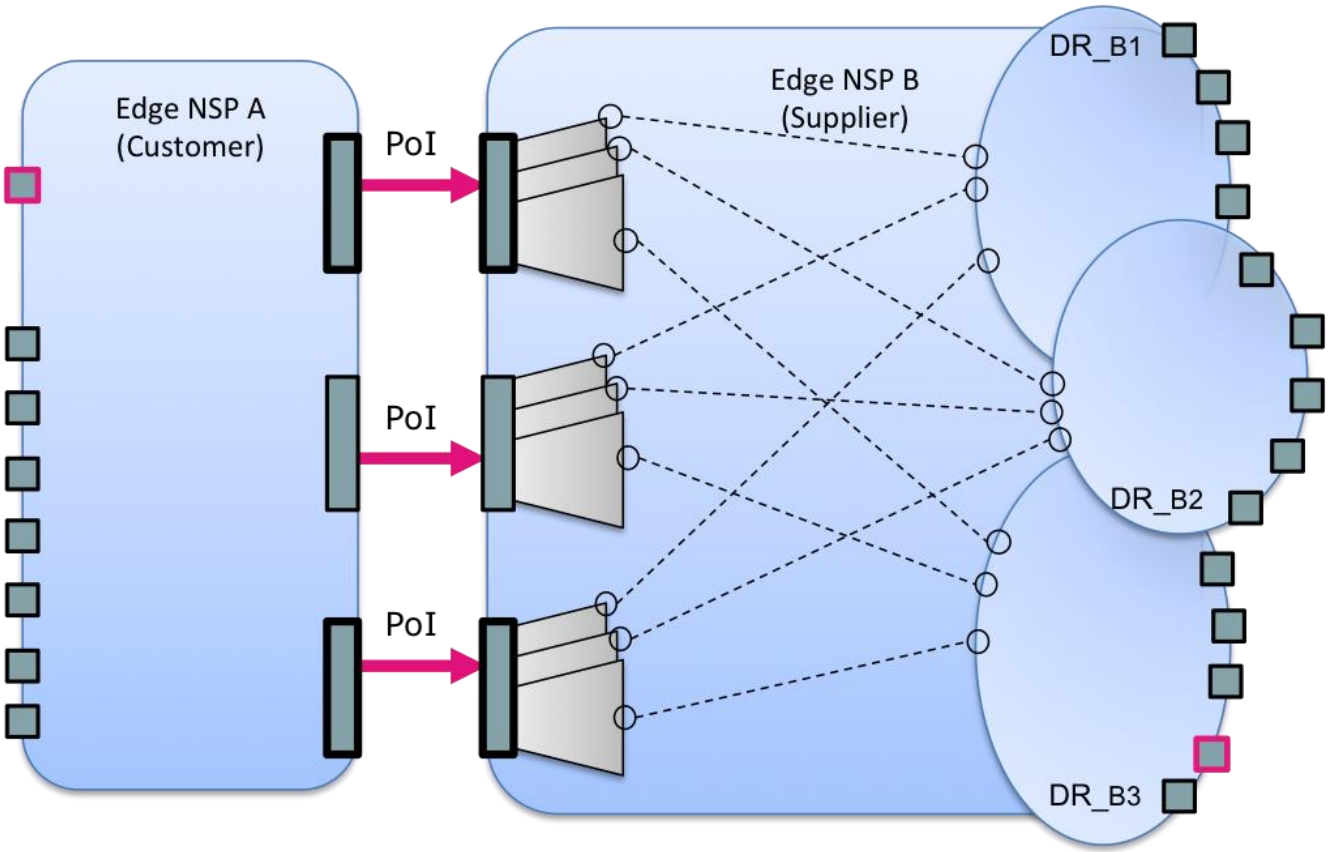
- Traffic engineered between data centers and end user regions
- Requires additional data in ALTO maps
  - Network capacity, latency…
  - And temporal aspects

Cross-Domain Scenarios



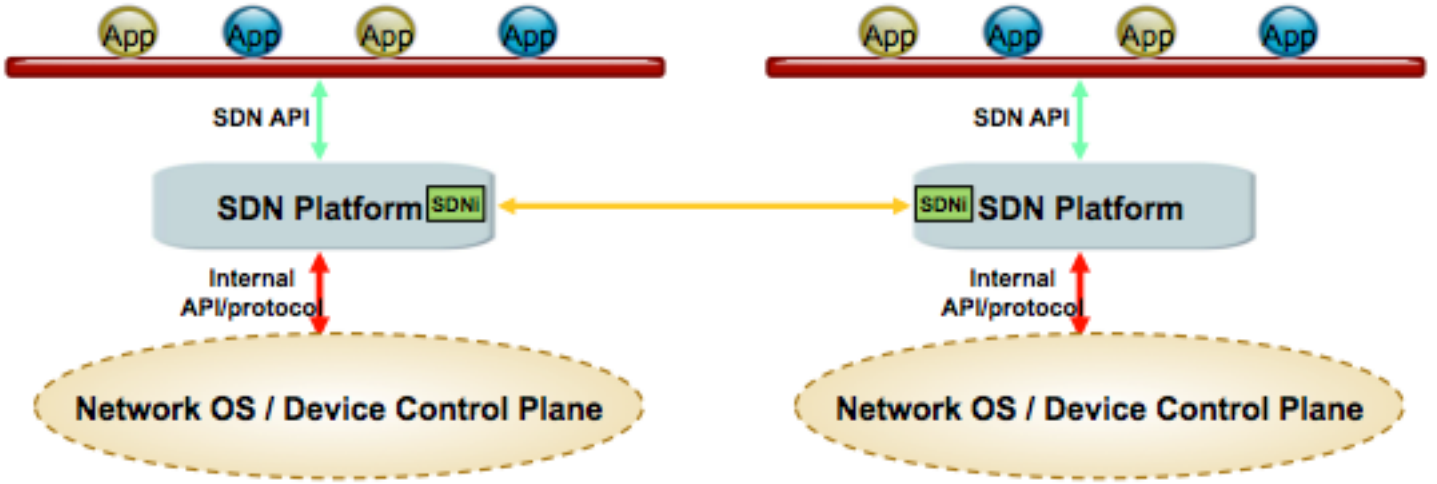
- Cross-connection of clients (controllers) to servers
- ALTO server adapts abstract views to each client
- Cross-domain maps become and additional input for controller policies
- ALTO as part of the Eastbound API

Inter-NSP ASQ



- Abstraction to avoid exposing data not necessary for interconnection
- Extensions to accomplish SLA matching and verification
  - In addition to network capacity and temporal constraints

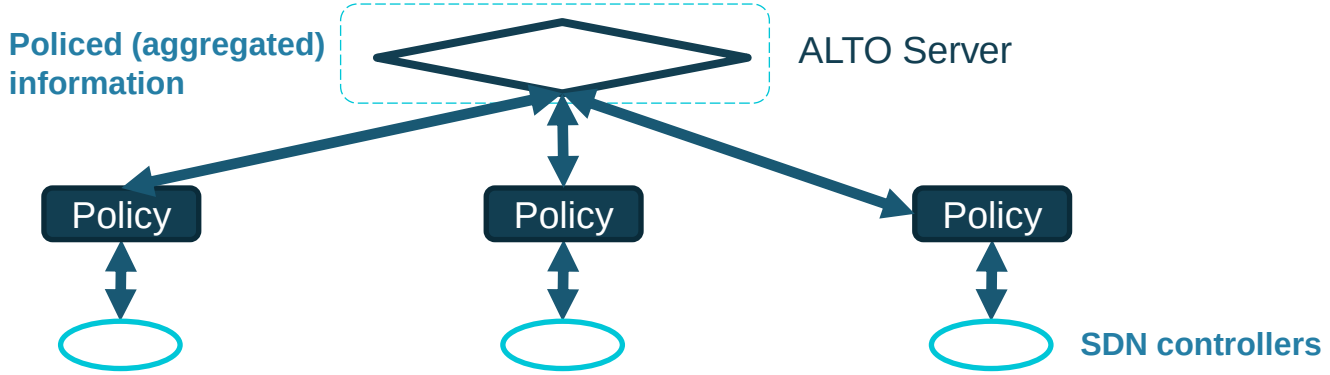
SDN Realm Partitioning



- SDN partitioning is inevitable
  - A large network is likely to be divided into multiple SDN realms
  - Each SDN realm with its own controller
- Some reasons
  - Scalability
  - Manageability
  - Privacy
    - Privacy policies applied to tenants or special applicable policies
  - Incremental deployment
- Partitioning is already a common practice
  - FlowVisor-enabled slices
- SDNi: An interface mechanism between SDN controllers

ALTO SDNi

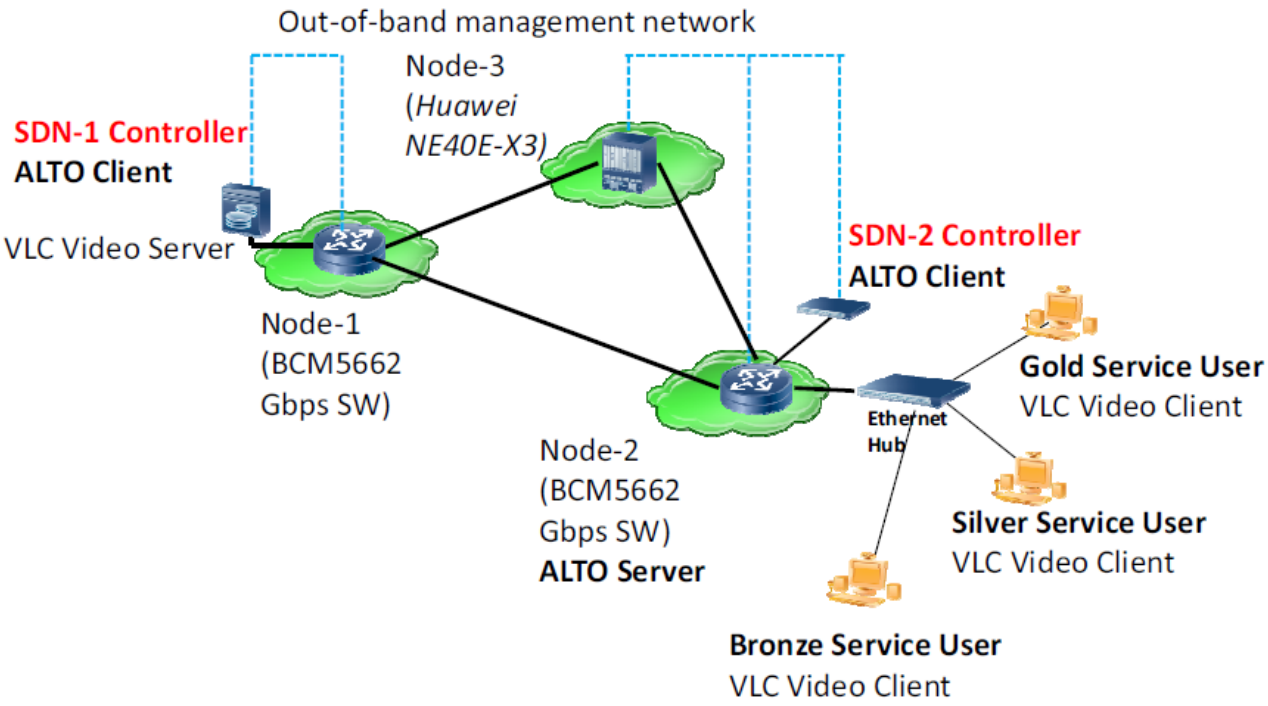
- SDN controllers communicate by exporting and importing network information through an ALTO server
- Information exchange is subject to realm-specific policies
- The ALTO server acts as network data orchestrator
  - Control decisions are autonomously taken by controllers
- ALTO as part of an evolved Eastbound (North-East-bound?) API



Making It Happen

- The ALTO server becomes a “soft” orchestrator
  - No need for a controller hierarchy, mesh, chain, or…
  - Policy driven
- Flexible arrangements
  - Controllers retain autonomy
  - “Multi-homing” is possible
  - And different policies at each attachment link
- Neutrality
  - With respect to positioning in the realm(s)
  - With respect to SDN flavor
- But we need to
  - Decide on extensions to ALTO data models
  - Enhance two-way interactions, session management and timely updates
  - Explore mechanisms for security, discovery, policy declaration, attachment modes…

First Results…



- Proof of concept
  - An ALTO server coordinating OpenFlow controllers in two separate realms
- Demonstrated at IETF 84
  - Recent report in the IETF Journal

...And Early Conclusions

- ALTO is suited to play a key role in SDN orchestration
  - Taking advantage of an abstracted network model
  - While retaining controller autonomy
  - And flexibly applying policies
- At the Northbound interface
  - Cross-layer orchestration
- At the Eastbound interface
  - Inter-provider services
- At an evolved Eastbound interface
  - Policy-driven
  - Flexible
  - Neutral
- Promising initial results
  - And some fun ahead


Telefónica