Limitations of Optimization for Multi-site NFV Network Service Delivery

Use Cases and Early Analysis

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Premise

- Orchestration with integrated planning algorithms for SDN/NFV is necessary to deliver optimal utilization of compute and networking infrastructure and the successful delivery of services (over multiple locations)
- To date, the definitions and development of these in SDOs and open source projects have been independent
- This is a reasonable time for the IETF (IRTF) to engage in identifying requirements, architecture options, and possible implications for current (legacy) functions and protocols

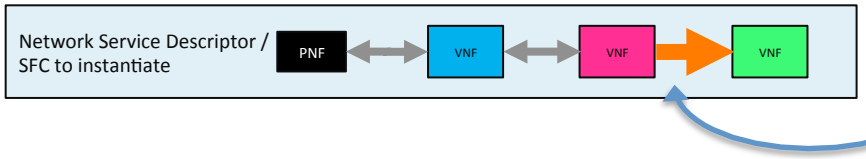
Motivation

- SDN / NFV is expected to reduce OPEX and CAPEX
- Orchestration solutions expected to
  - Maximize the utilization of infrastructure – compute, storage, network
  - Keep costs low
  - Deliver network services that meet SLAs
  - Follow policies
  - Minimize migrations
- Tradeoffs – Utilization vs. SLAs
- NFV and SDN orchestration solutions are separate and independent
  - Orchestration for NFV / SFC (MANO)
  - Orchestration for networks (SDN, PCE)
  - **Deployment planning computations must be unified or cooperative**

Activities

- Review use cases
- Review current SDO and open source projects and current research literature
- Review (some) options for unification / cooperation
  - LCM (activation)
  - Roles
  - Information passing
  - Possible requirements
- Review possible impact on IETF definitions
- Develop informational drafts describing use cases and requirements

Simple Network Service



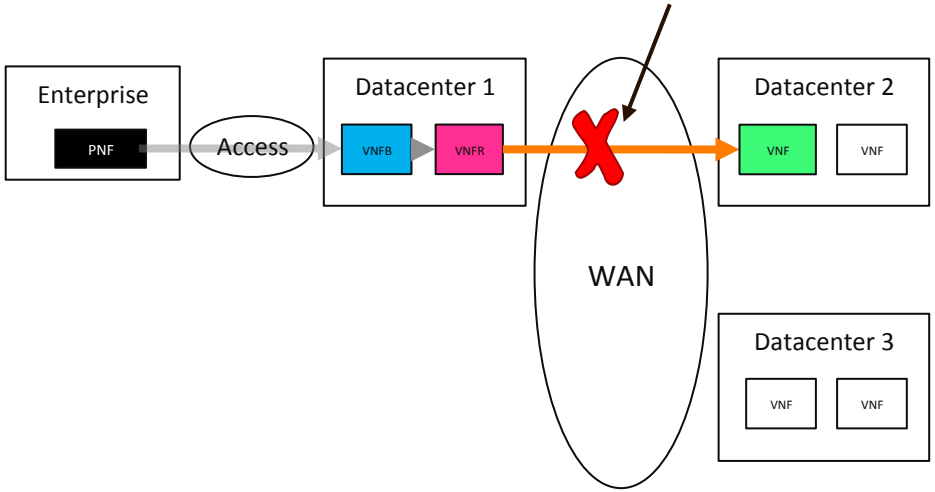
Service definition, from network service descriptor
Low latency and jitter required between VNF R and VNF G.

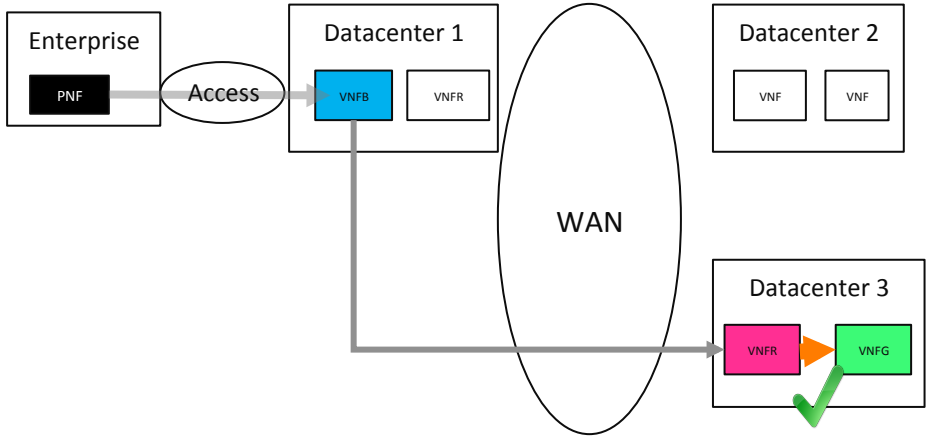
Solution 1 – independent planning

NFV orchestration algorithm computes VNF locations based on policies, NFVI resources, costs, etc
Solution does not account for network congestion

Solution 2 – Unified or Collaborative planning

Solution considers network service conditions. Low latency and jitter requirement between VNF R and VNF G is met. Lower cost with VNF B in DC 1.





vCDN and virtual IoT (Sensors) Gateways High Volume Rapid Deployment

- Need to support a rapid rise in source and access to information
  - Emergency, e.g. Nice
  - Rock concerts – shared videos
  - Natural disasters – sensor data
- NFV enables makes possible the dynamic, elastic, and scalable deployments
  - Sensor gateways
  - vCDNs, cache servers
  - Real-time data
- Must consider network, compute and storage, etc. all together

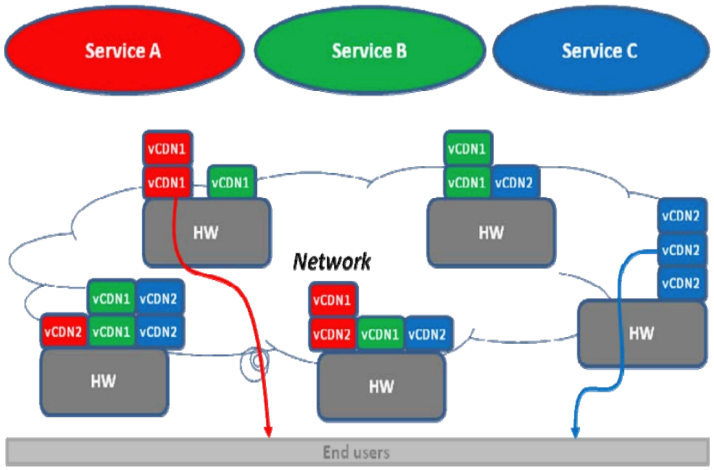
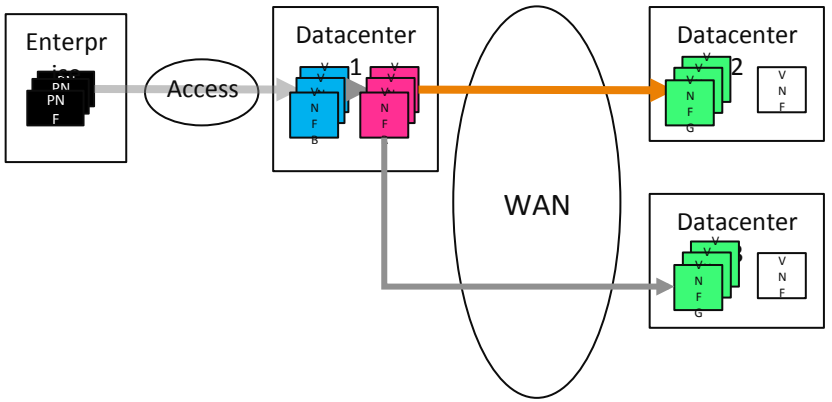


Figure 26: principle of different vCDN cache nodes deployment in Virtualised environment

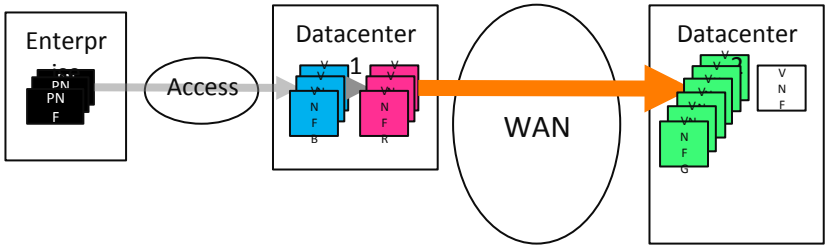
Service Deployment Adjustments - Migrations

- Monitoring and analytics indicate it is time to re-configure the deployment of some services
- Examples
  - Consolidate services to fewer datacenters, reduce energy usage and costs
  - Reduce network delays due to congestion
  - Reduce chance of service interruptions / SLA violations – move paths from OTN circuit showing increased errors
- Migrations are to be avoided
  - Impact on service performance – SLA
  - Each service deployment must consider broader optimization implications

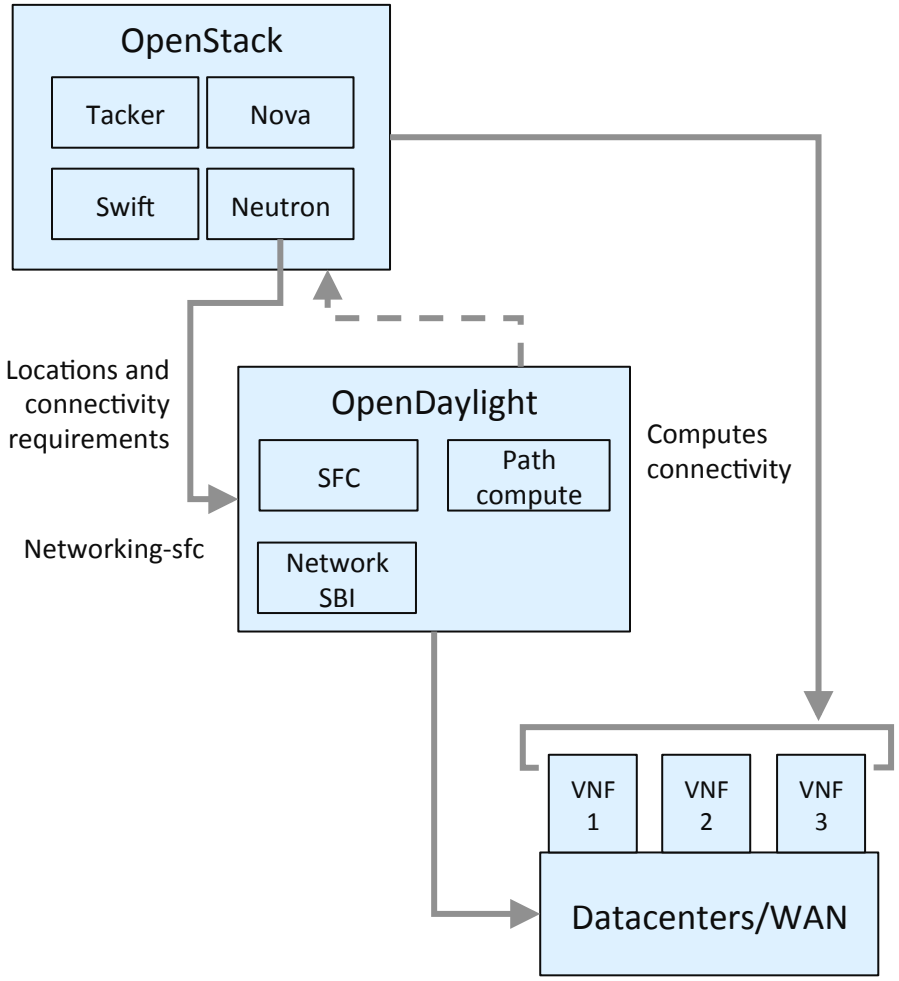
Opportunity to consolidate to Datacenter 2 and reduce operating costs of DC 3.



Consolidation raises usage of WAN connection between DC 1 and DC 2. Even after path re-computation, the congestion, latency and loss may be increased to an unacceptable level. A better overall solution would be possible if the optimization algorithms were integrated or cooperative.



Openstack with OpenDaylight – Split Optimization



- OpenStack
  - Receives a network service request via Tacker
  - Chooses how and where to implement with Nova, Swift
  - Communicates SFC connectivity graph via Neutron (networking-sfc)
- OpenDaylight
  - Processes connectivity needs and computes connections to meet requirements
  - Establishes connectivity using underlying networking technology
  - No feedback possible to OpenStack for smarter VNF placement

ETSI Architecture

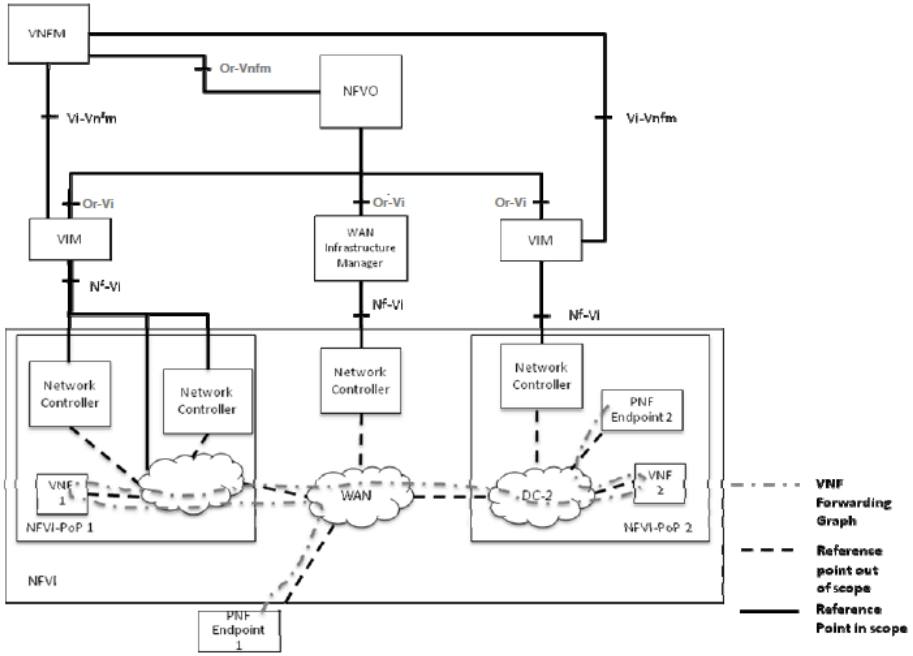
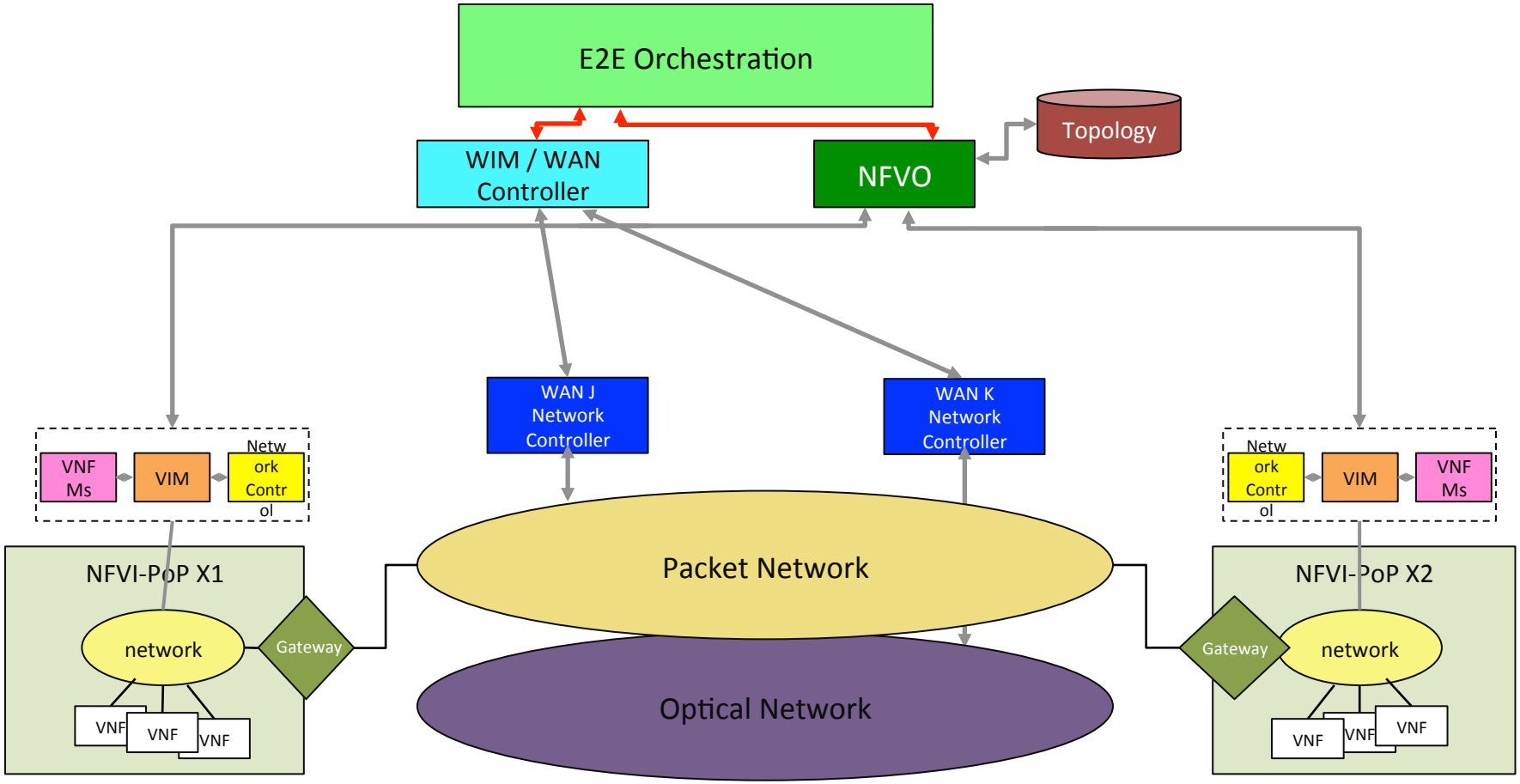


Figure 5.2: Network Controller example

- Introduces WIM as integration point from NFVO to WAN Controller

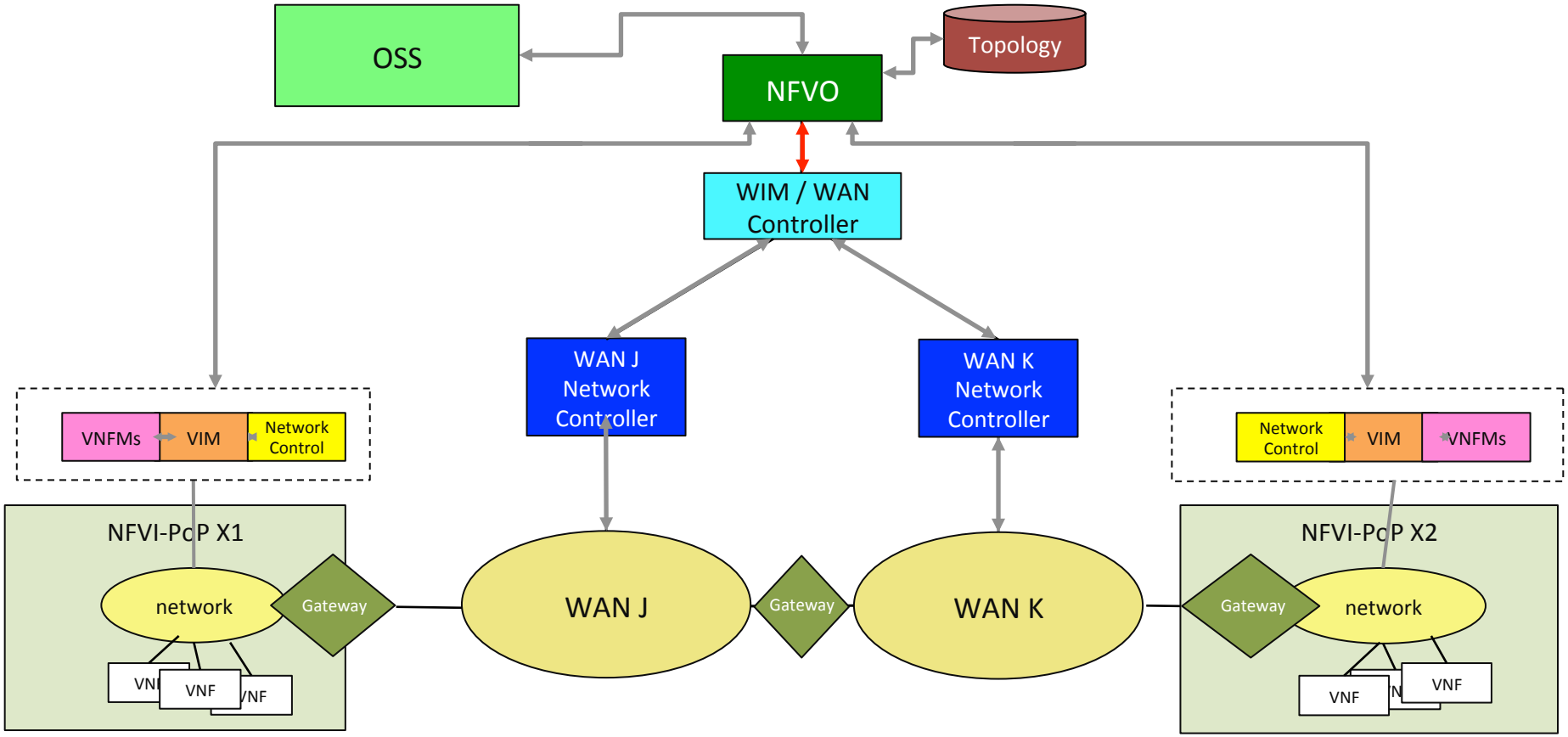
E2E Orchestrator Controls NFV and Network

- Used in a number of open source
  - E.g. Open O, MEF LSO, TMForum

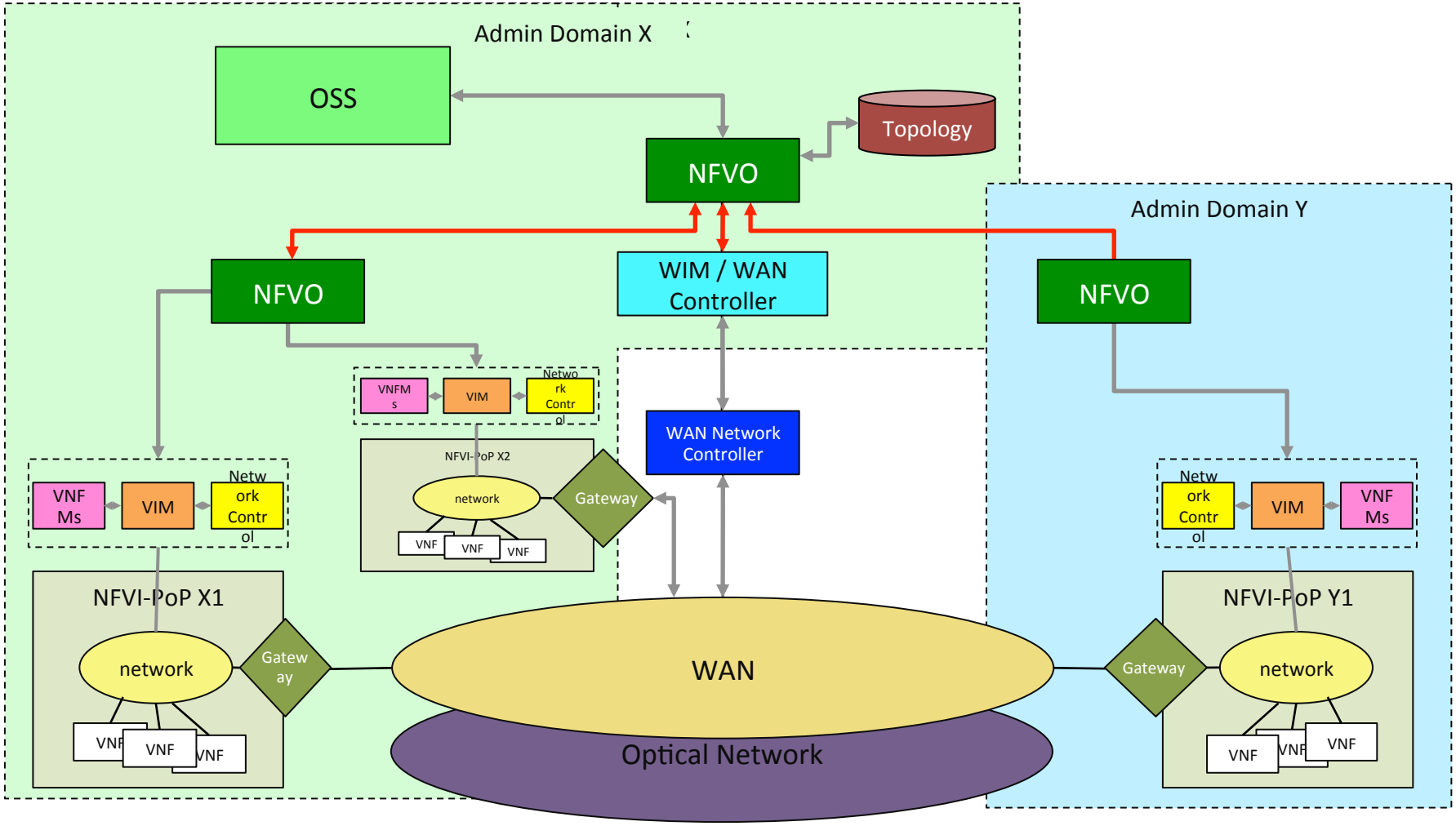


NFVO Collaborates with WAN Controller

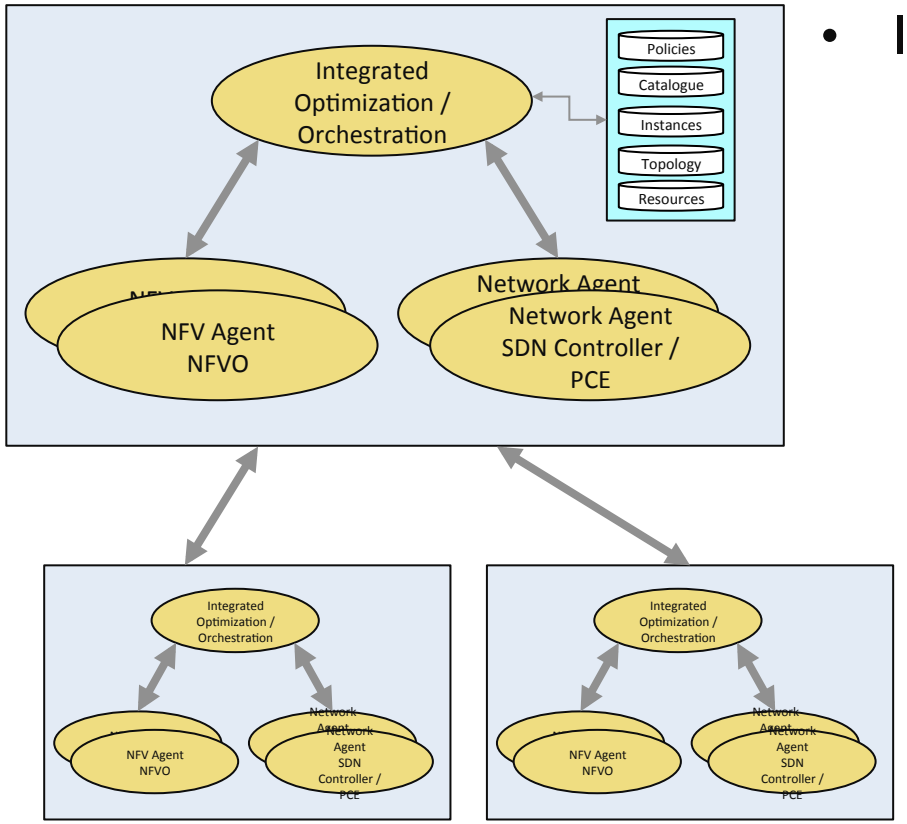
- Used in some open source
  - SONATA



Hierarchical and Multiple NFVOs



Common Agents Across Architectures



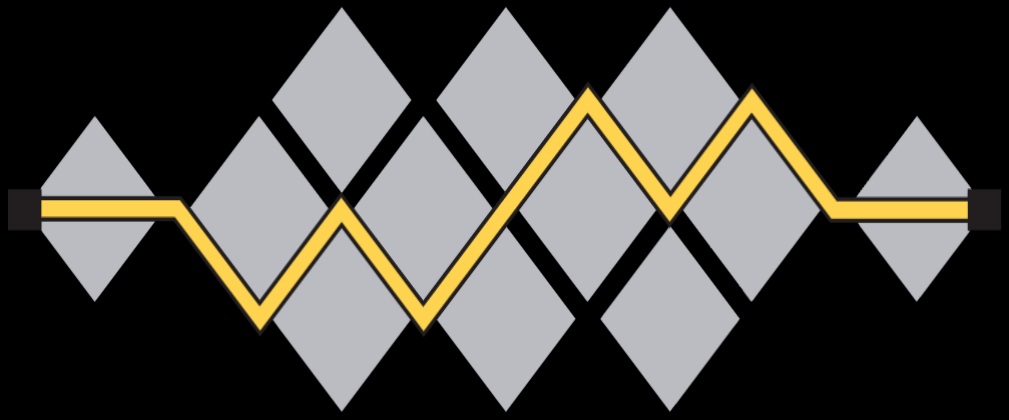
- Identify
  - Possible roles of agents
    - Where are functions located
    - Multiple options
  - Knowledge representation options
    - What is necessary to enable the rapid computation
    - Information distillation or summarization
      - KPI, policies, etc
  - Implications on functional blocks and communications
    - Controllers, PCE, etc
    - What information is exchanged and when
  - Develop requirements

Next Steps

- Continue use case definitions and analysis an document
- Develop requirements and document
- Evolve (update) and validate, repeat
  - Coordinate in open source, etc.

Relevant IETF Work

- PCE
  - PCEP
- TEAS
  - Controller based TE / Hybrid
- ALTO
  - NFV/SDN
- SFC
  - H-SFC
- YANG modeling



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