Management and Orchestration of Virtualized Network Functions

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Outline

- Research project overview
- Trends and challenges
- Management and Orchestration of VNFs
- Experimental results
- Conclusion and next steps

Telecom Italia research project

Research project:

"From a Network connecting Edges to Edges building up a network"

Reference-macro topic:

Software Defined Networks at the Edge

***Specific topic**:*

Management and orchestration of Virtualized Network Functions

Vision: trends and challenges

Trends

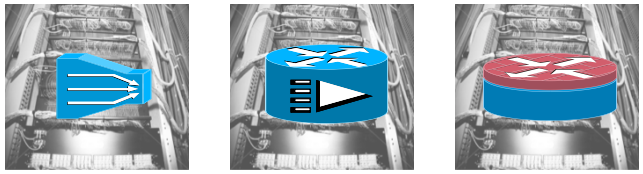
- Convergence of computing, storage and networks
- New virtualization technologies (e.g. Network Function Virtualization, NFV)
- Software Defined Networking (SDN)

Challenges

- Launching new services is difficult, takes too long and often requires proprietary boxes to be integrated into existing systems
- Huge capital investment to deal with current trends
- Complexity: large and increasing variety of proprietary hardware appliances in operator's network
- Lack of flexibility and agility: no ability to move network resources where/ when needed

Setting the ground

Traditional Network model



- Network functionality **based on specific HW/SW**
- **One physical node per role**

Effect of **scale**

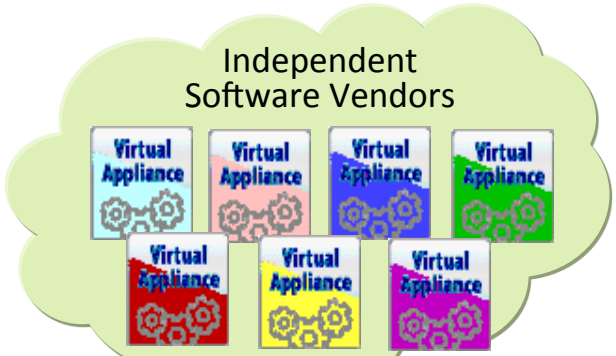
Reduction of geographical **dispersion** of HW

CAPEX

Reuse same HW for different roles

OPEX

Virtualized Network model



Orchestrated, automatic and remote installation

High volume standard servers

High volume standard storage

High volume switches

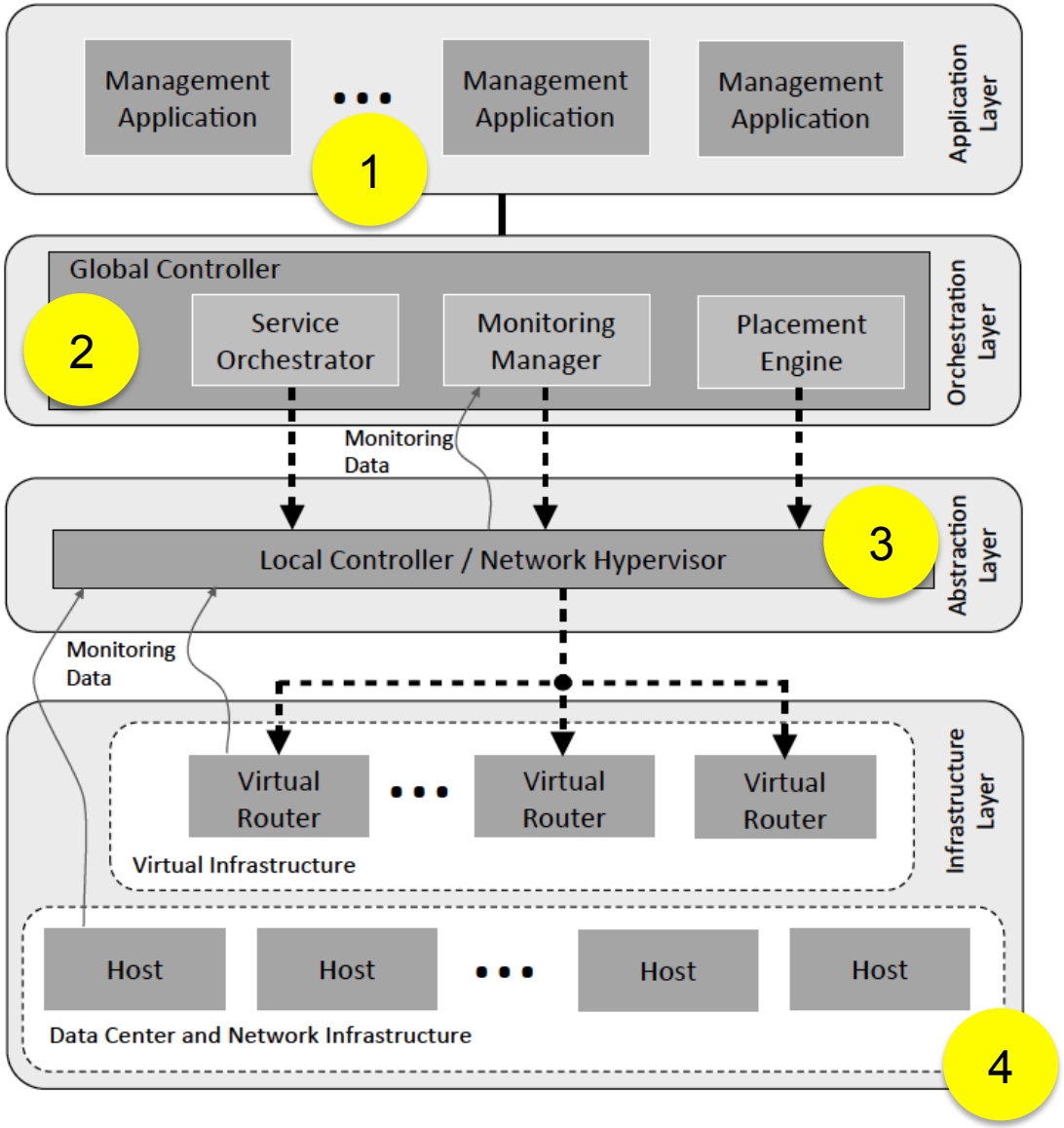
Main drivers

NFV
Network functions and software running on any open standards-based hardware

ORCHESTRATION
Automation, provisioning and interworking of physical and virtual resources

SDN
Separation of control and data plane

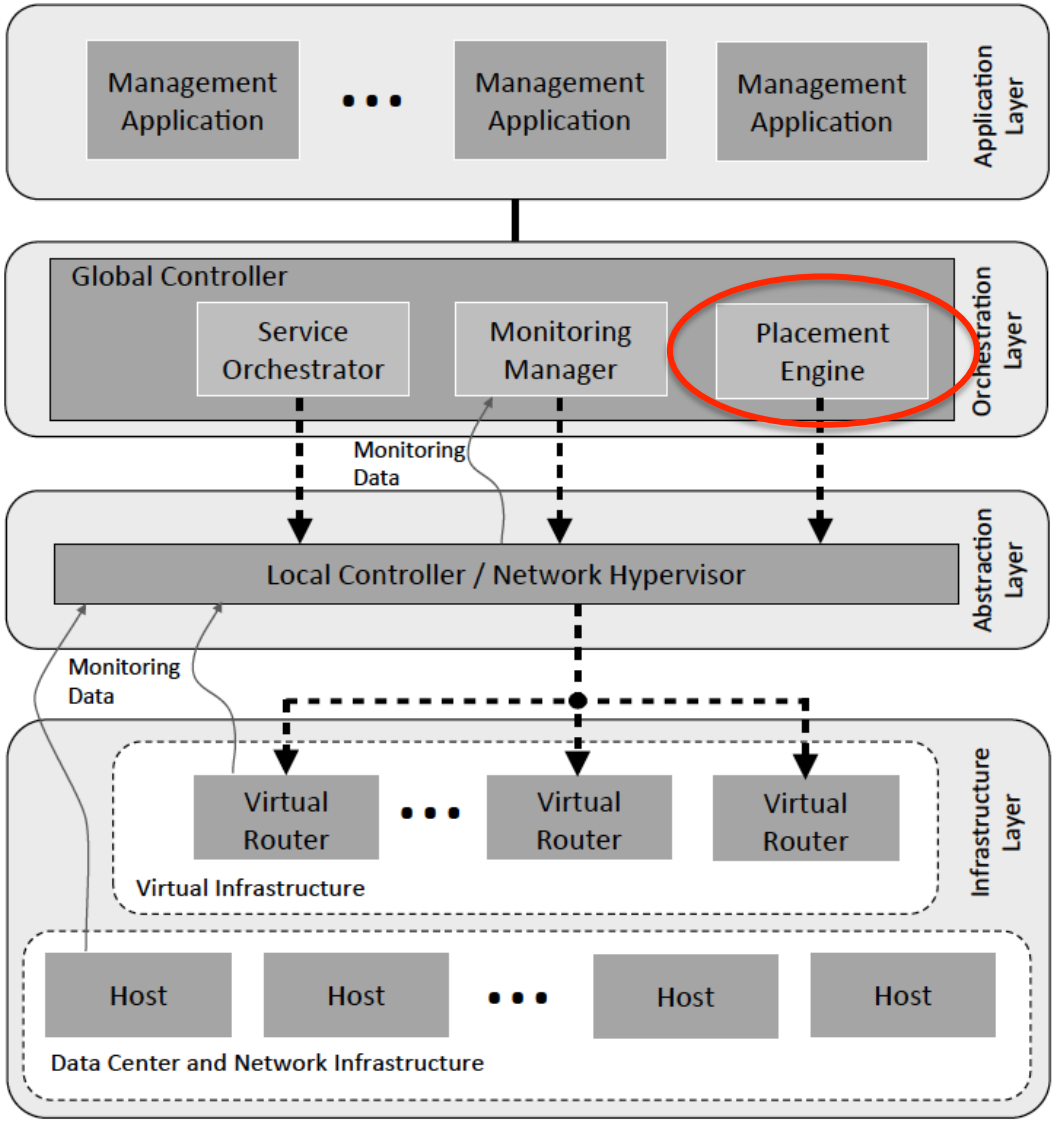
… a framework for the dynamic placement of virtualized network functions



4 main layers:

1. Application Layer
2. Orchestration Layer
3. Abstraction Layer
4. Infrastructure Layer

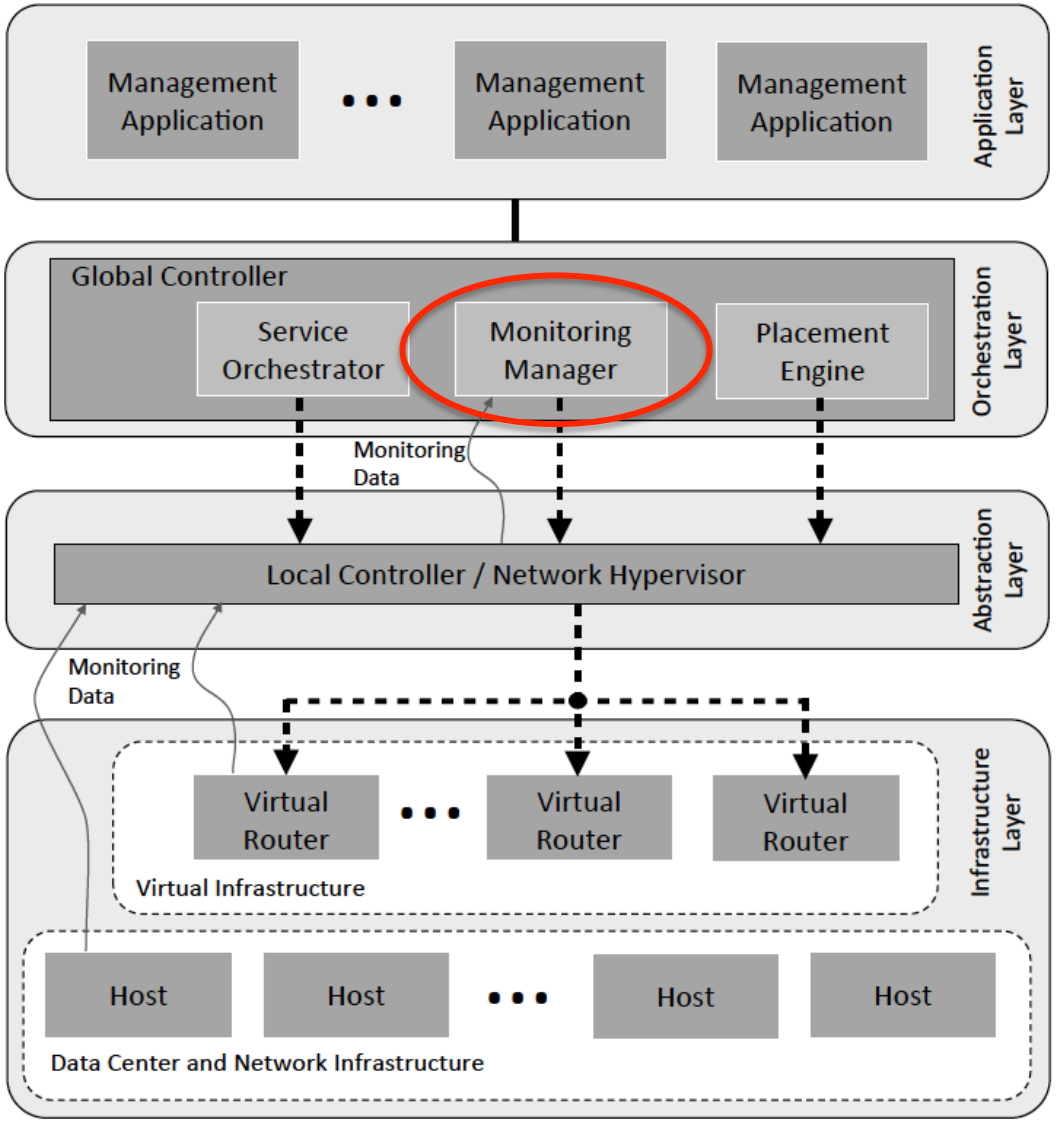
… a framework for the dynamic placement of virtualized network functions



Placement Engine:

- Placement of the virtual routers
- The "*best*" place is chosen according to a set of constraints and policies

… a framework for the dynamic placement of virtualized network functions



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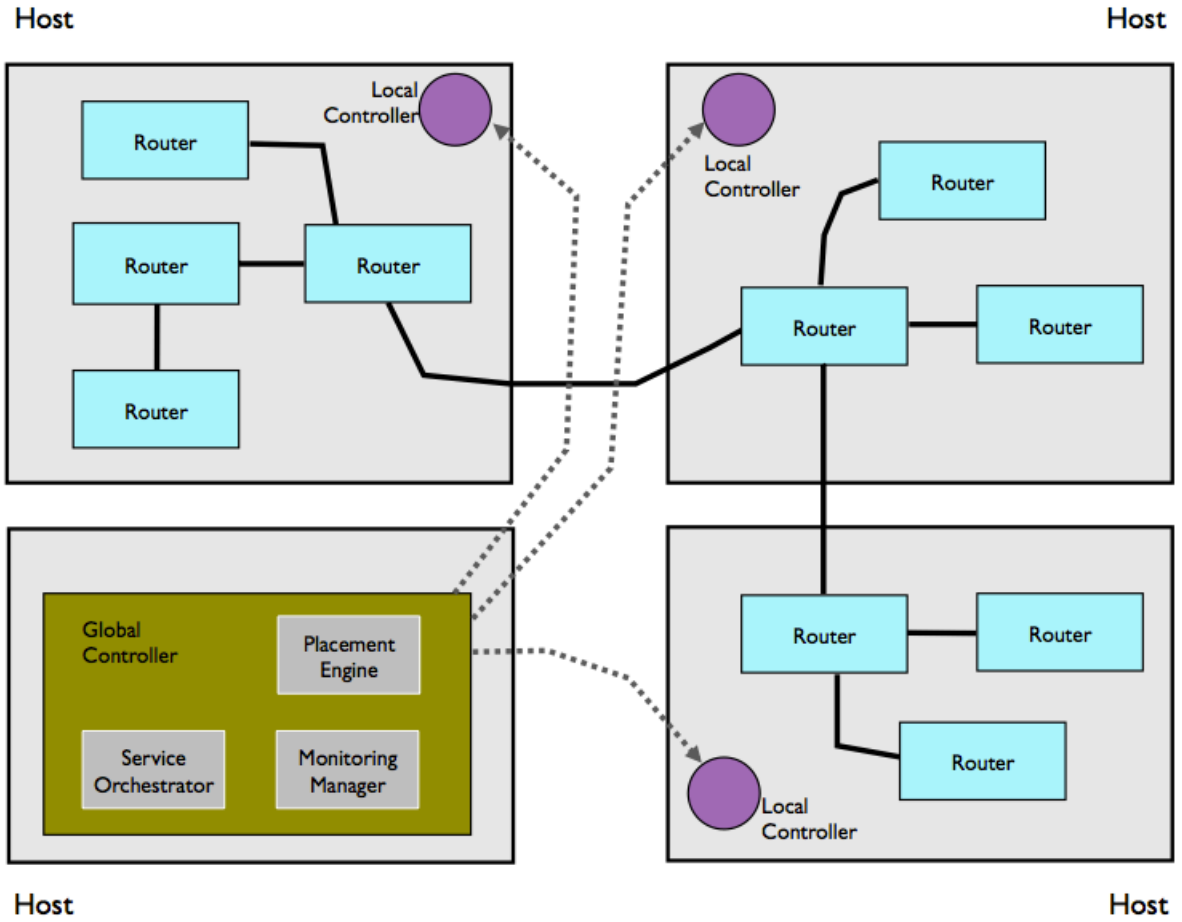
Monitoring Manager:

- Physical and virtual resources are monitored by probes
- Collected data are used by the engine for the placement

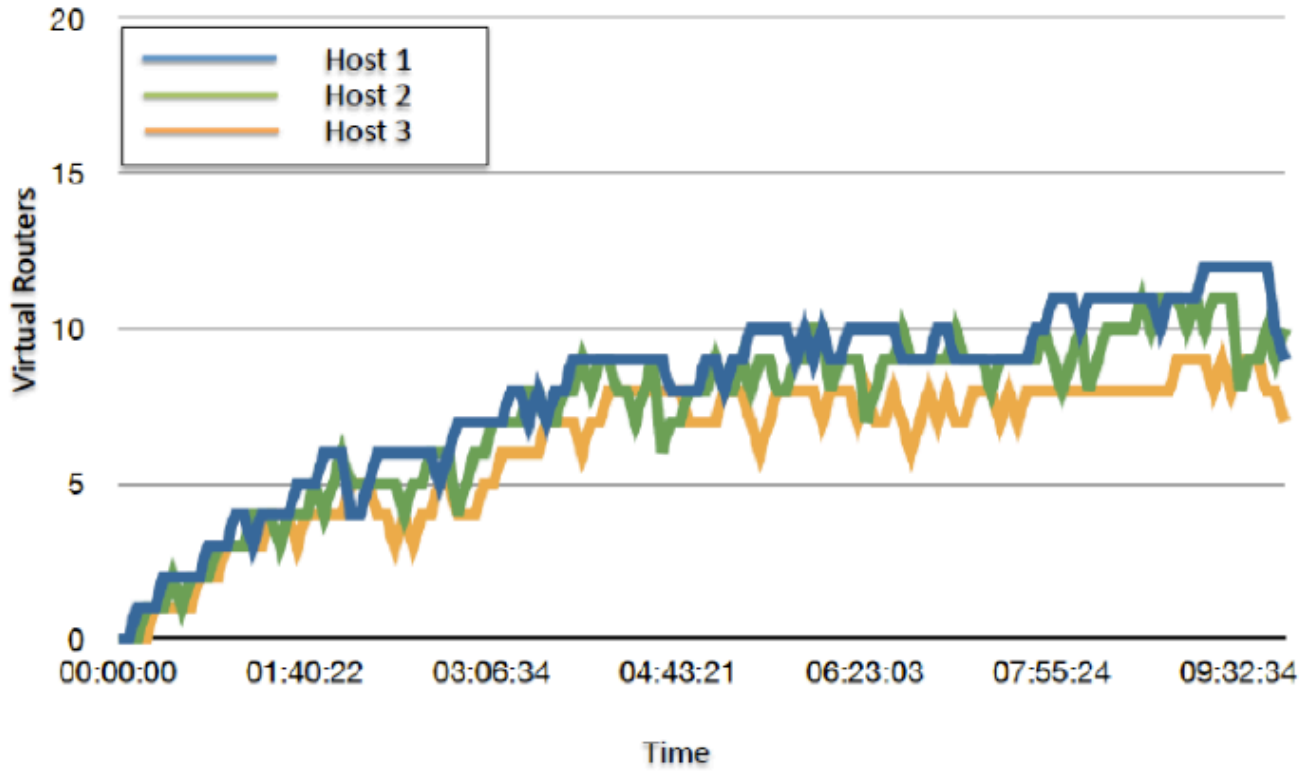
Validation

- Very Lightweight Service Platform (VLSP)
  - implemented at UCL
- Case study



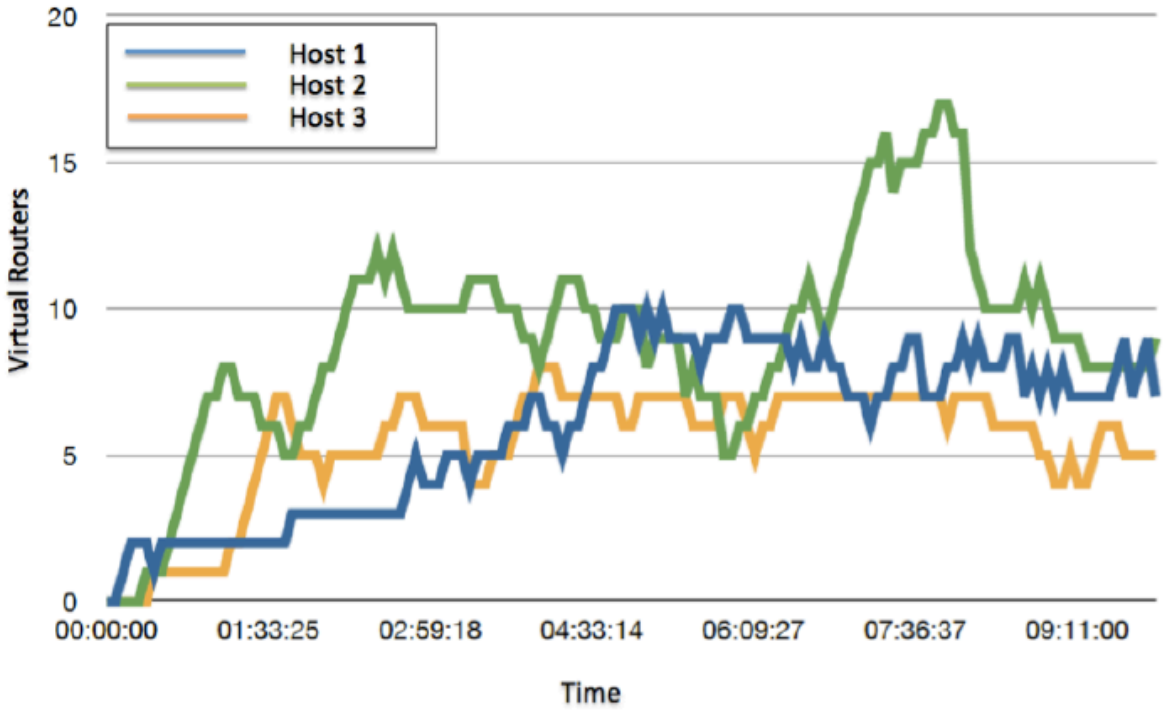
Placement Engine: Least Used

- Collect the number of virtual routers allocated to each physical host that has the least number of virtual routers
- If more than one host is at the minimum level, then a random host is chosen
- Load balancing algorithm trying to get a similar number of routers on each host



Placement Engine: Least Busy

- Determine the host that is least busy in terms of virtual network traffic
- Collect monitoring data from all the virtual routers in the virtual network and calculate how much virtual traffic has been sent on each of the hosts
- The host that has the lowest amount of traffic since the last placement decision is chosen as the host for the current placement



Conclusion and next steps

- As a proof of concept, architectural elements have been designed and implemented and some experimental results using the VLSP testbed presented
- We have shown how the Placement Engines can allocate different virtual routers on different physical hosts depending on several factors (i.e. infrastructure metrics or VN metrics)
- The results presented demonstrate that the different embedded algorithms in each Placement Engines give very different placement strategies for each virtual routers
- It is expected that over time the placement algorithms for virtual routers will become more complex and factor-in metrics from both infrastructure and virtual resources, and also to consider placement across multiple data centers

Acknowledgements

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Thanks for your attention!