

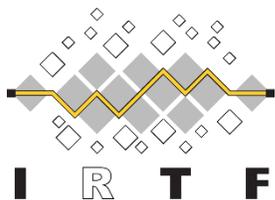
# SDN Placement Challenges

## NMRG

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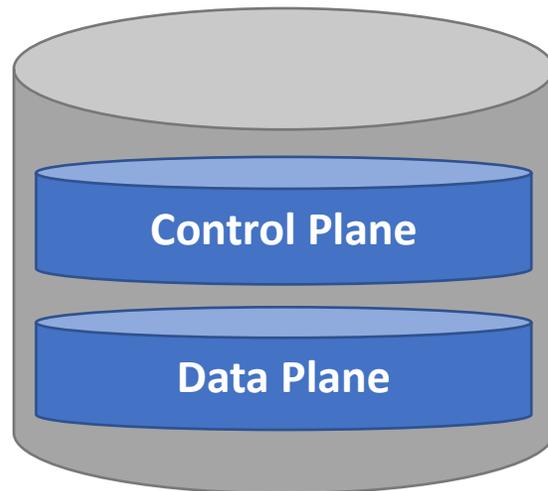
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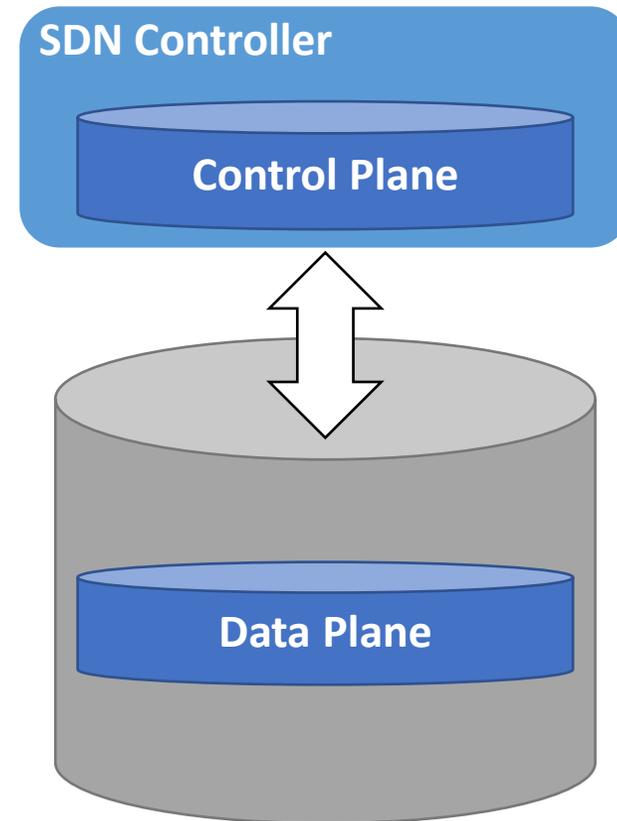
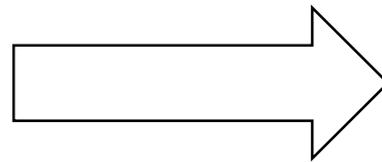


# A Brief Review: SDN

- In a nutshell.... SDN is a paradigm that decouples the control plane from the data plane

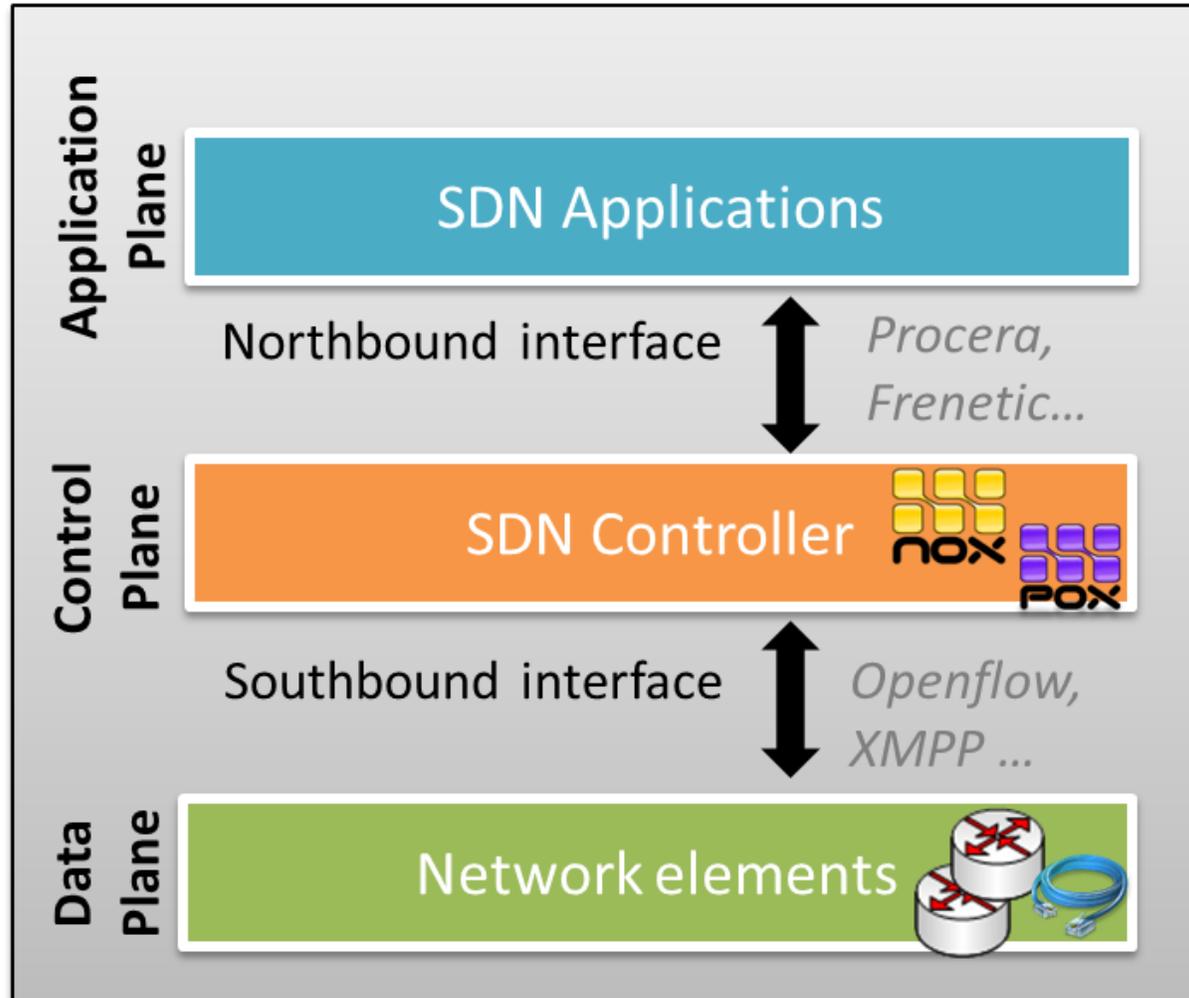


Traditional Switch/Router



SDN Switch/Router

# A Brief Review: SDN



# A Brief Review: SDN

- A Single point of failure -> Dependability Analysis
- Performance Overhead -> Planning and Provisioning
- Flow Setup Time -> Controller position is important!

# Research Questions....

- How many controllers are required to cover a network?
- **What is the best placement position for each SDN Controller?**
- What is the cost of each controller?
- What should be the capacity of each controller?
- How to manage multiples SDN Controllers in a same network?
- **What should be the capacity of each controller?**
- How to manage the rules and network policies in a centralized way?
- **How to deploy virtualized SDN Controllers?**

# Research Questions....

How to categorize these problems



# SDN \* Placement Problem

(1) SDN Controller Placement Problem

(2) SDN Rule Placement Problem

(3) SDN Hypervisor Placement Problem

# SDN Controller Placement Problem

SDN Controller Placement Problem (CPP) deals with the allocation of SDN controllers in a network.

Acadêmico

Aproximadamente 6.080 resultados (0,06 s)

Artigos

**Dica:** Pesquisa para resultados somente em **português (Brasil)**. Você pode especificar seu idioma para pesquisa em Co

Minha biblioteca

**The controller placement problem**

[B Heller](#), [R Sherwood](#), [N McKeown](#) - ... of the first workshop on Hot topics ..., 2012 - dl.acm.org  
... **controller placement** has immediate relevance: Internet2 is constructing a 34-node **SDN** [4] and ... A more recent example is the relationship between an **OpenFlow switch** and **controller**; the **switch** ... including a star (a single controller), a hierarchy (a set of **controllers** connected in ...  
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A qualquer momento

Desde 2017

Desde 2016

Desde 2013

Período específico...

**Pareto-optimal resilient controller placement in SDN-based core networks**

[D Hock](#), [M Hartmann](#), [S Gebert](#)... - ... (ITC), 2013 25th ..., 2013 - ieeexplore.ieee.org  
Abstract: With the introduction of Software Defined Networking (**SDN**), the concept of an external and optionally centralized network control plane, ie **controller**, is drawing the attention of researchers and industry. A particularly important task in the **SDN** context is the  
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Classificar por relevância

Classificar por data

**The SDN controller placement problem for WAN**

[P Xiao](#), [W Qu](#), [H Qi](#), [Z Li](#), [Y Xu](#) - ... in China (ICCC), 2014 IEEE/CIC ..., 2014 - ieeexplore.ieee.org  
Abstract: Large networks are always partitioned into several small networks when deploying software defined networking (**SDN**). The network partitioning with **SDN** control planes open many unanswered questions such as latency, reliability, and load balancing. This paper  
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Em qualquer idioma

Pesquisar páginas em Português

**Heuristic approaches to the controller placement problem in large scale SDN networks**

[S Lange](#), [S Gebert](#), [T Zinner](#), [P Tran-Gia](#)... - ... on Network and ..., 2015 - ieeexplore.ieee.org  
Abstract: Software Defined Networking (**SDN**) marks a paradigm shift towards an externalized and logically centralized network control plane. A particularly important task in **SDN** architectures is that of **controller placement**, ie, the positioning of a limited number of  
Citado por 59 Artigos relacionados Todas as 3 versões Citar Salvar

 incluir patentes incluir citações Criar alerta**On the capacitated controller placement problem in software defined networks**

[G Yao](#), [J Bi](#), [Y Li](#), [L Guo](#) - IEEE Communications Letters, 2014 - ieeexplore.ieee.org  
... 7–10. [3] G. Yao, J. Bi, and L. Guo, "On the cascading failures of multi-controllers in software ... [5]

# SDN Controller Placement Problem

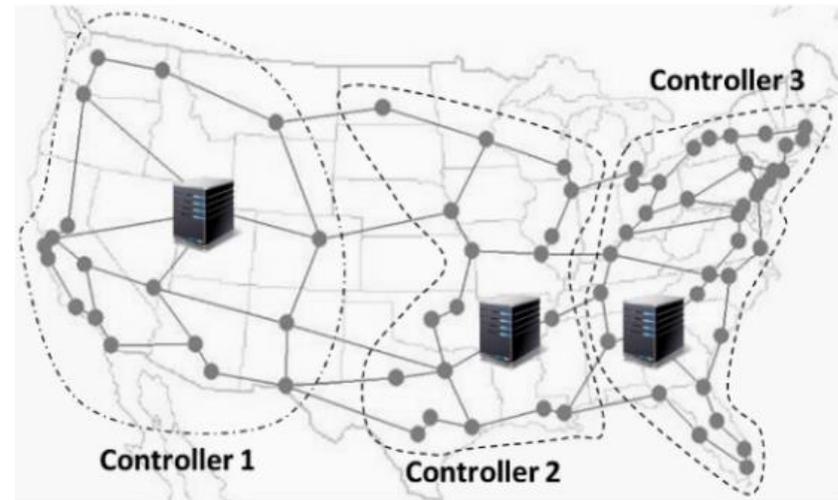
- How many controllers are required
- Where to place them
- What is the controller domain (switches controlled by each controller)

CORONET Continental United States (CONUS) Topology:



(a)

CORONET Continental United States (CONUS) Topology:



(b)

# SDN Rule Placement Problem

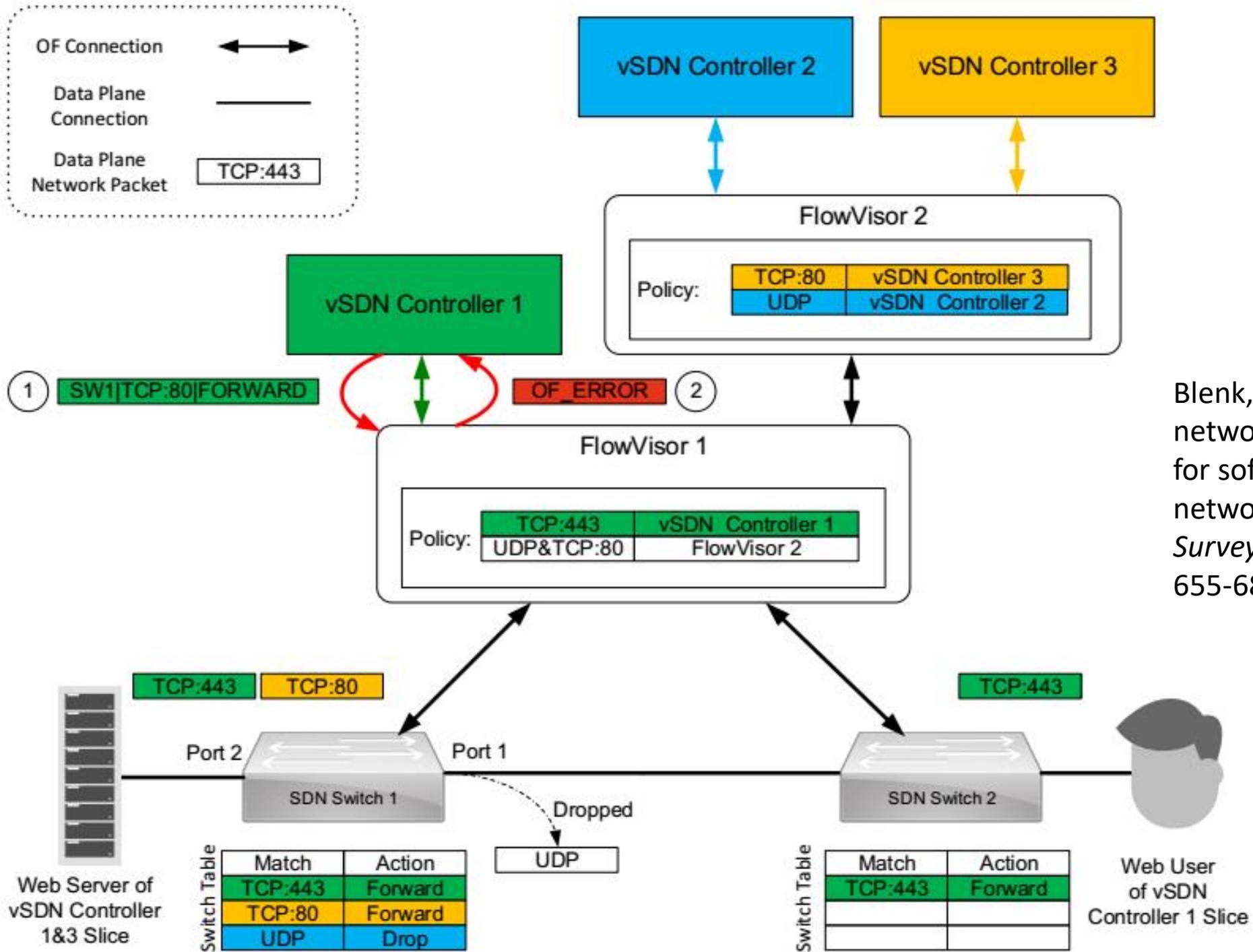
A rule placement solution deals with which rules must be deployed in the network and where.

# SDN Rule Placement Problem

- Different types of rules: access control, routing policy, traffic shaping, or traffic engineering rules such as rules for load balancing
- Real-time decision
- How to handle rule conflicts or policies
- Flow rules installed in a reactive, proactive, or hybrid way

# SDN Hypervisor Placement Problem

A Hypervisor Placement solution deals with how many hypervisor instances are needed and their position.



Blenk, Andreas, et al. "Survey on network virtualization hypervisors for software defined networking." *IEEE Communications Surveys & Tutorials* 18.1 (2016): 655-685.

# SDN Hypervisor Placement Problem

“Similar to the controller placement problem, the placement of the hypervisor demands detailed investigations<sup>1</sup>”

- Where to deploy an SDN hypervisor
- Hypervisor Reliability and Fault Tolerance
- Scalable Hypervisor Design

<sup>1</sup>Blenk, Andreas, et al. "Survey on network virtualization hypervisors for software defined networking." *IEEE Communications Surveys & Tutorials* 18.1 (2016): 655-685.

# Optimization Techniques

What is the best technique...?

- What is the objective?
- What is the complexity of the problem?

# Optimization Techniques

- Exact resolution methods
  - Optimal solutions
  - Time-consuming when solving real-world problems
  - Branch and bound, dynamic programming and linear and integer programming
- Heuristics
  - Quasi-optimal Solution
  - Reasonable computation times
  - Genetic Algorithms, Simulated Annealing and Ant Colony Optimization

# Optimization Techniques

[Browse Journals & Magazines](#) > [IEEE Communications Letters](#) > [Volume: 19 Issue: 1](#) 

## Optimal Model for the Controller Placement Problem in Software Defined Networks

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# Draft Proposal

## Next Steps...

- Create a informational draft proposal identifying SDN \* Placement Problems, Challenges and Solution Directions