Sustainable Network Resource Management System for Virtual Private Clouds

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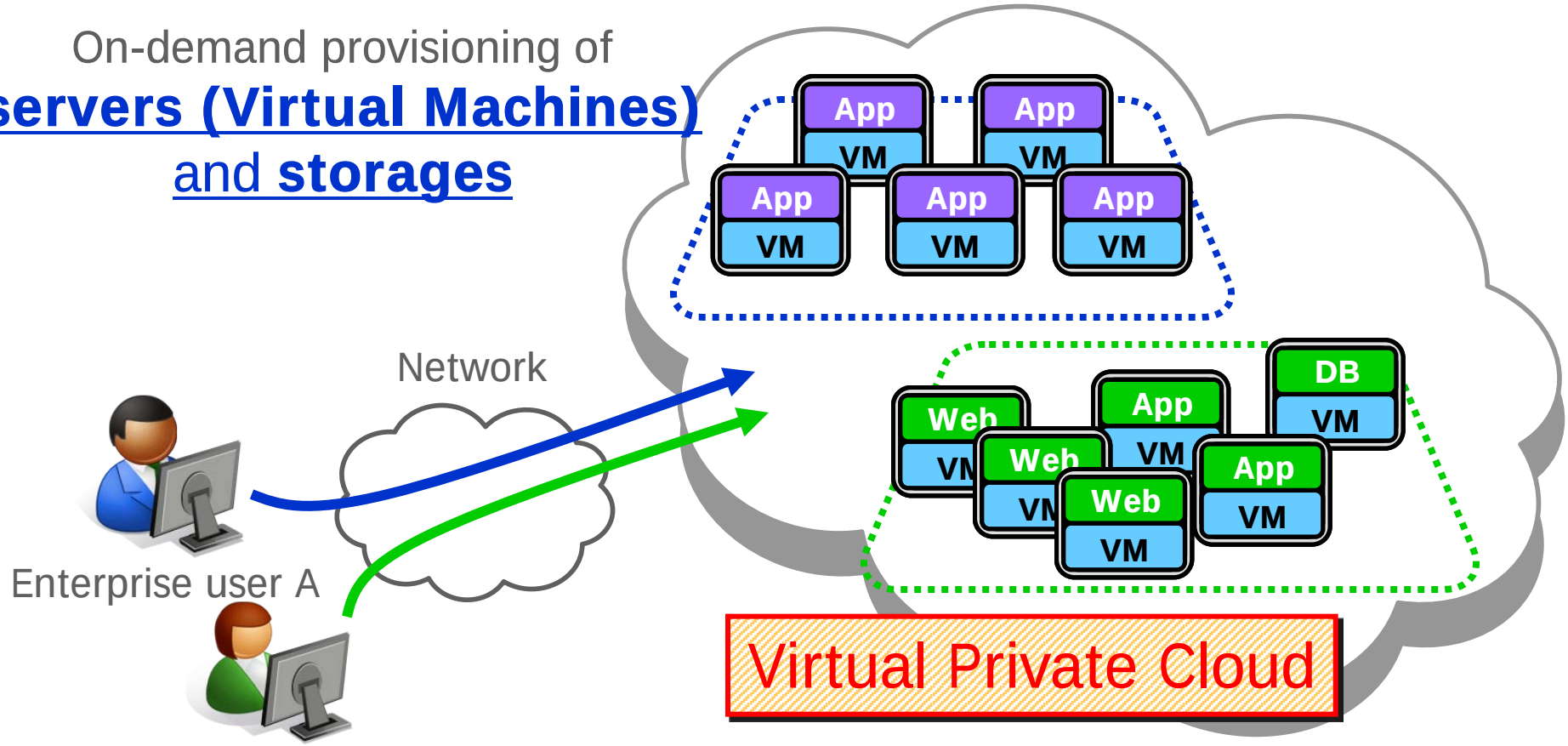
Cloud computing environment

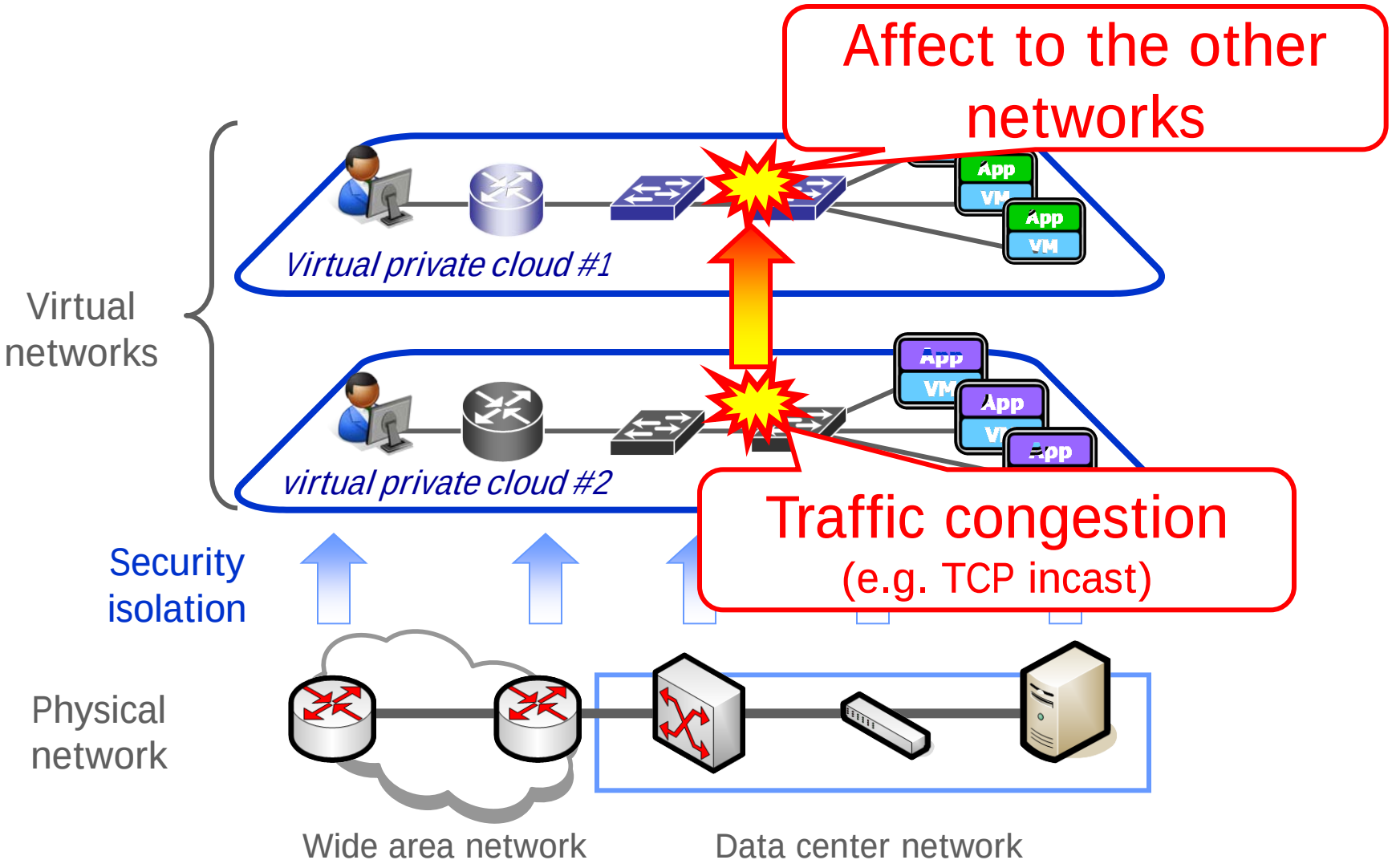
Infrastructure as a Service (IaaS)

On-demand provisioning of
servers (Virtual Machines)
and **storages**



...How about **network**?

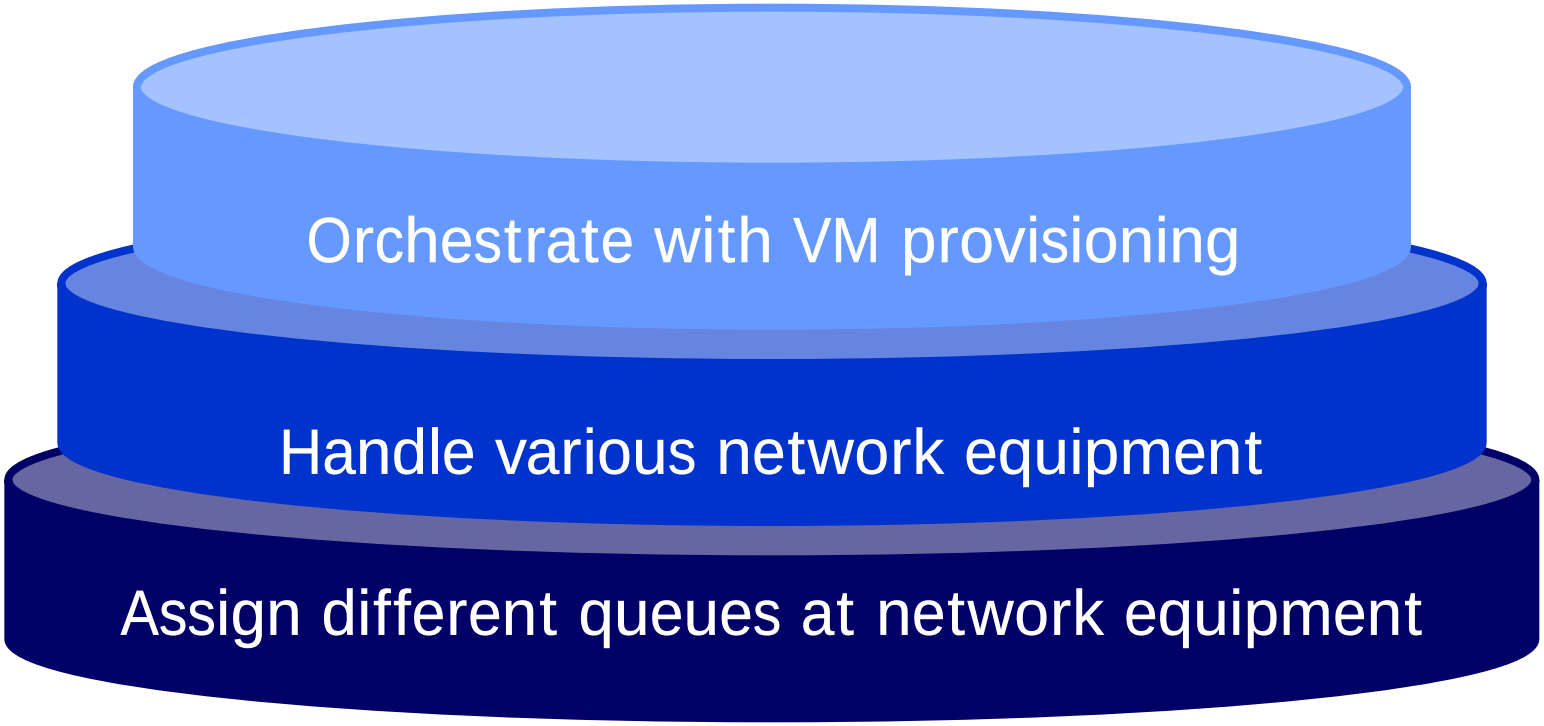
Problem of general virtual private clouds



Approach

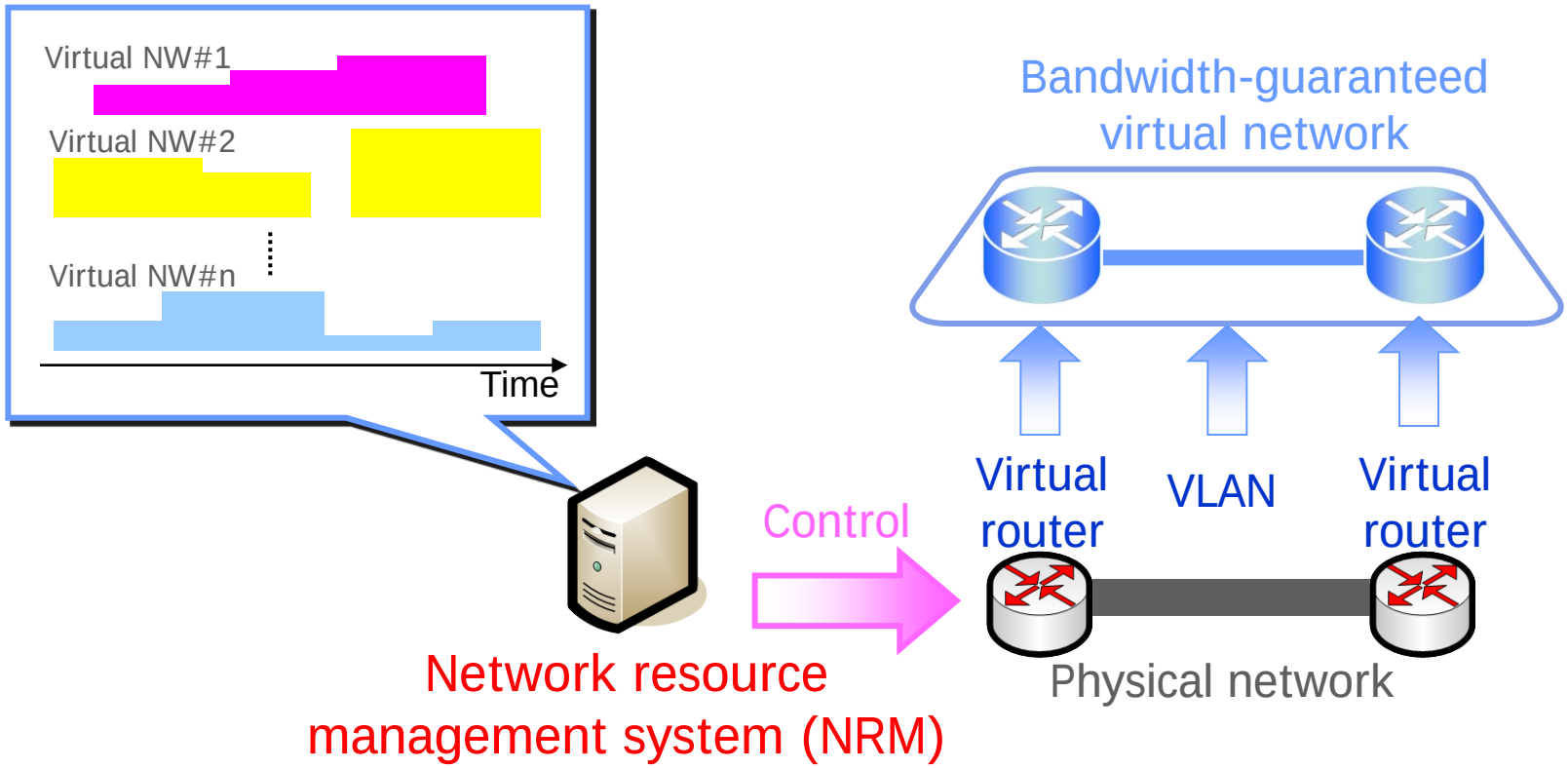
Objective:

Performance isolation among virtual private clouds



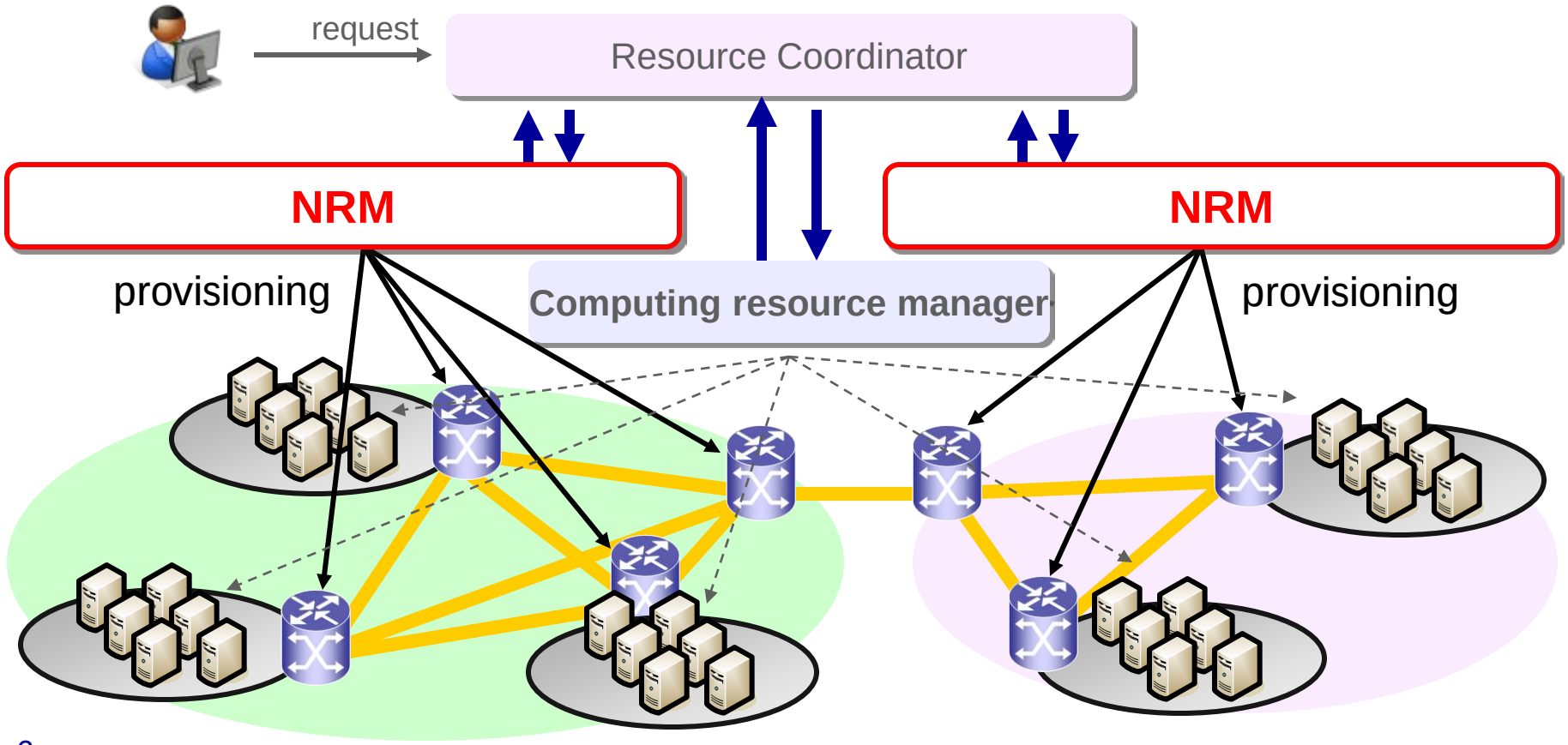
Network resource management system (NRM)

- Manages bandwidth and topology of physical network
- Allocates guaranteed bandwidth to each virtual network



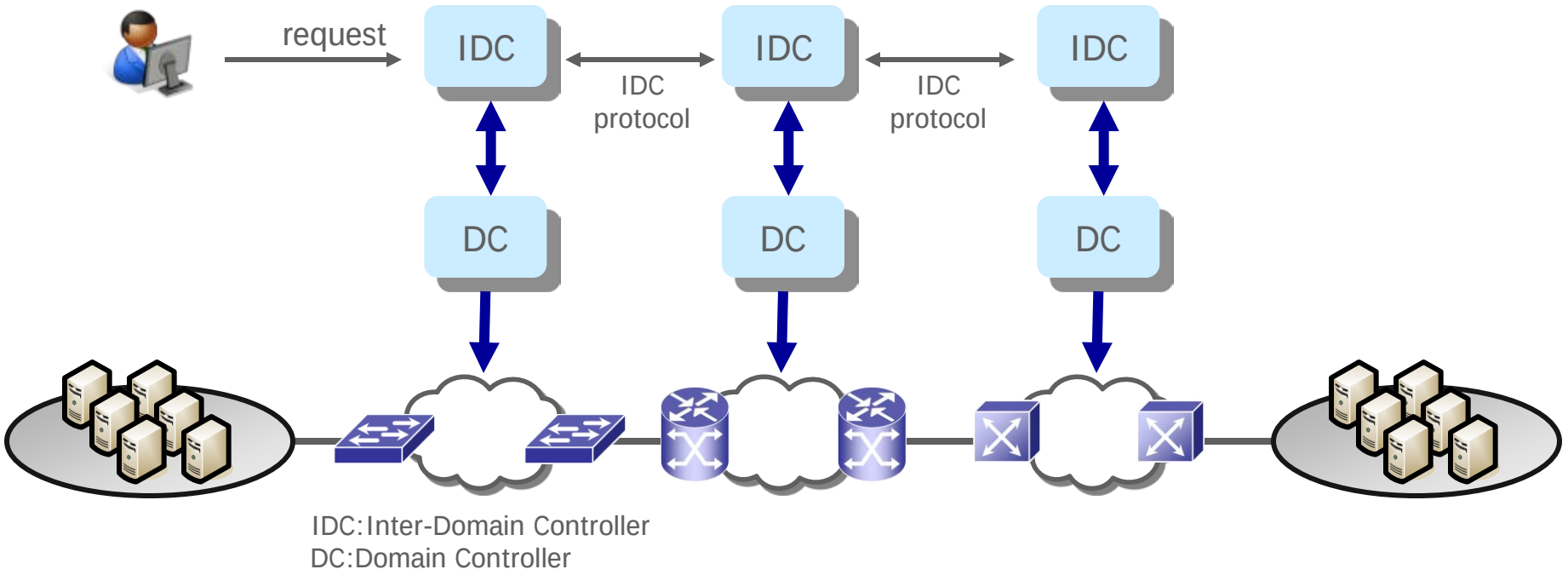
NRM (1) G-lambda project

- A joint project of NICT, AIST, NTT and KDDI R&D labs
  - To define and standardize the web service interface between network and applications

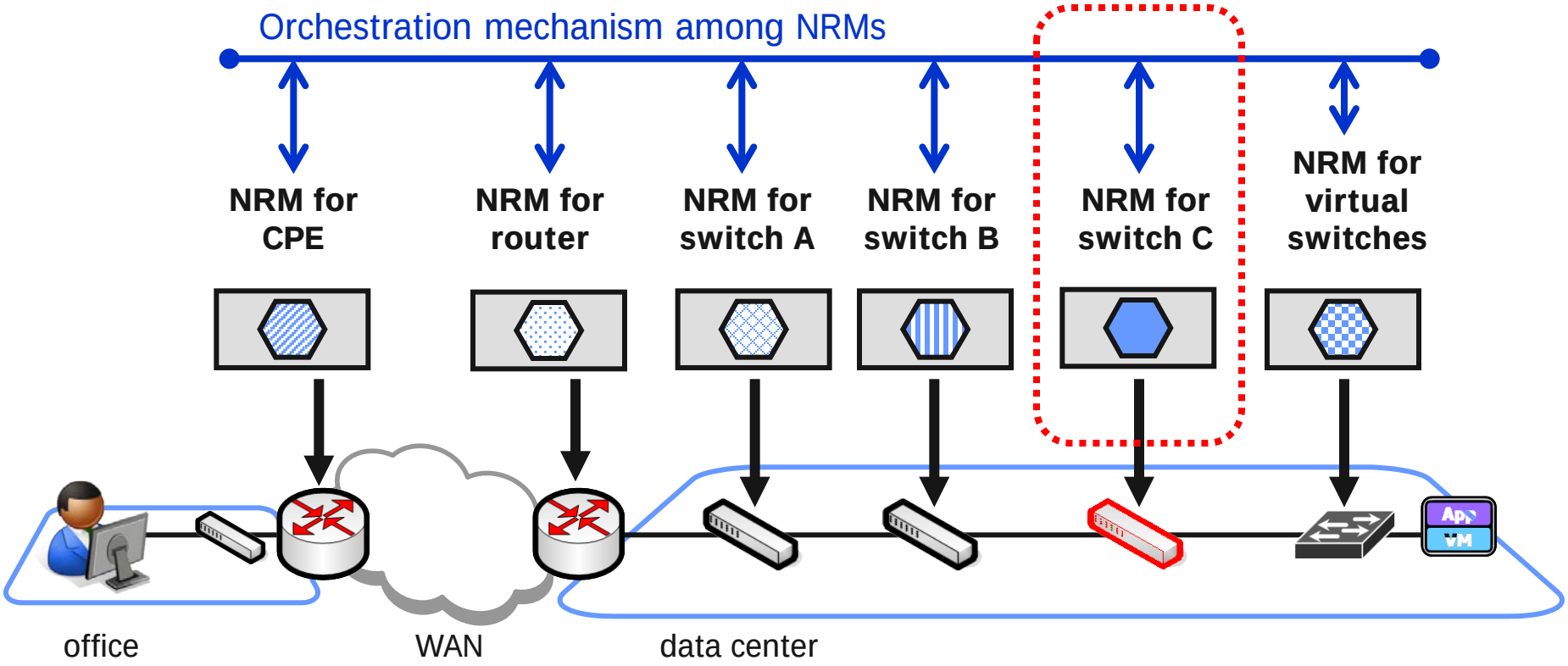


NRM (2) Dynamic Circuit Network

- A project of Internet2
- Multiple domains can negotiate by using the Inter-Domain Controller (IDC) protocol.



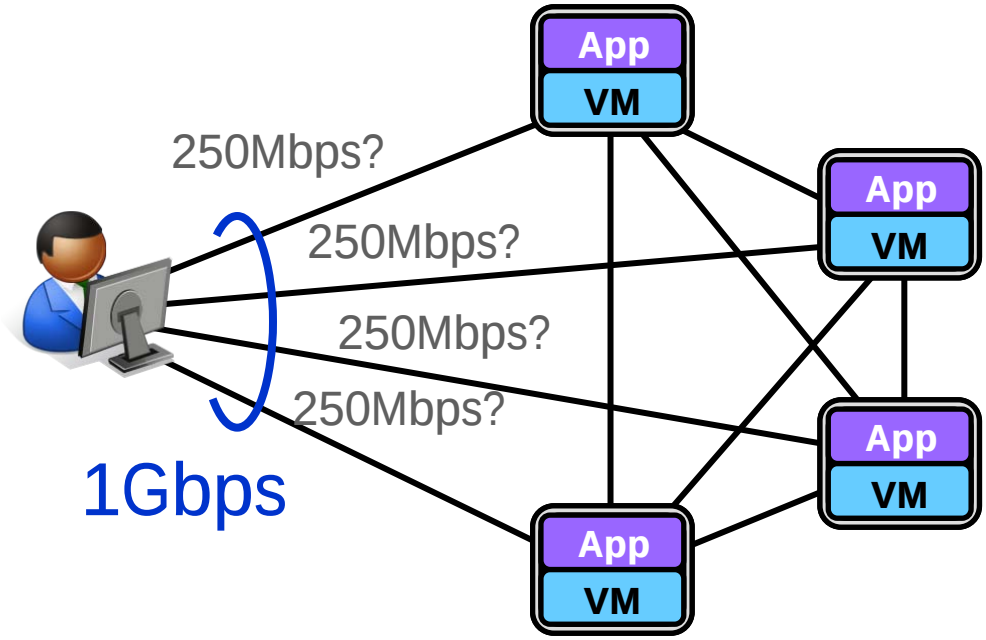
Problem to handle various network equipment



This model needs time and costs to develop new NRMs.

Problem to handle multipoint network

- NRMs can support only point-to-point provisioning
  - Full-meshed path provisioning
  - Bandwidth arrangement among paths

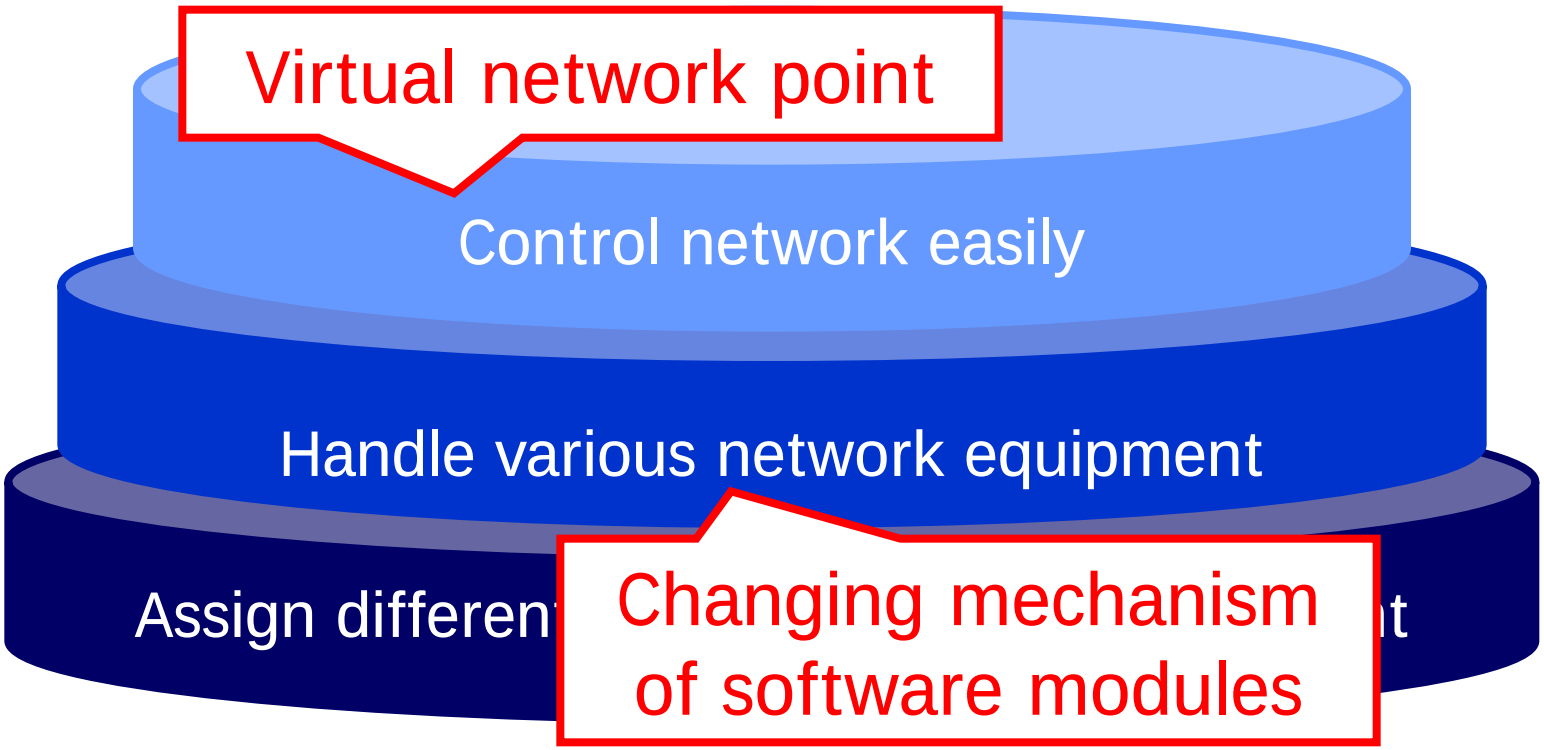


...too complicated to users

Proposed mechanisms

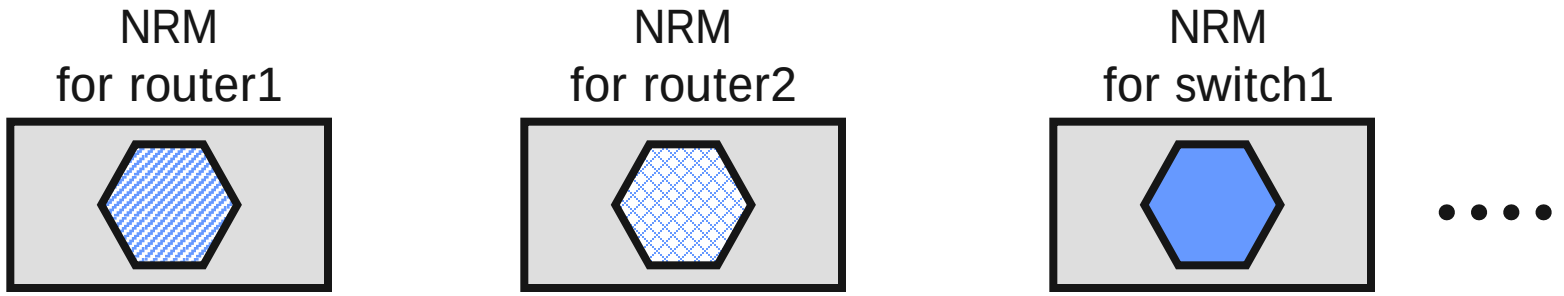
Objective:

Performance isolation among virtual private clouds



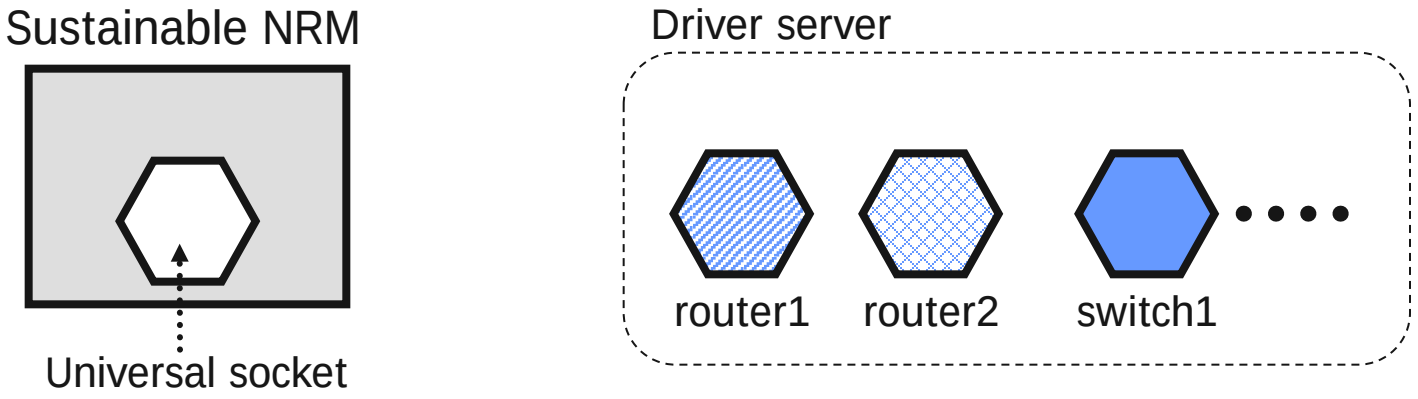
Problem of NRMs

Conventional NRM



Control drivers are **embedded**.

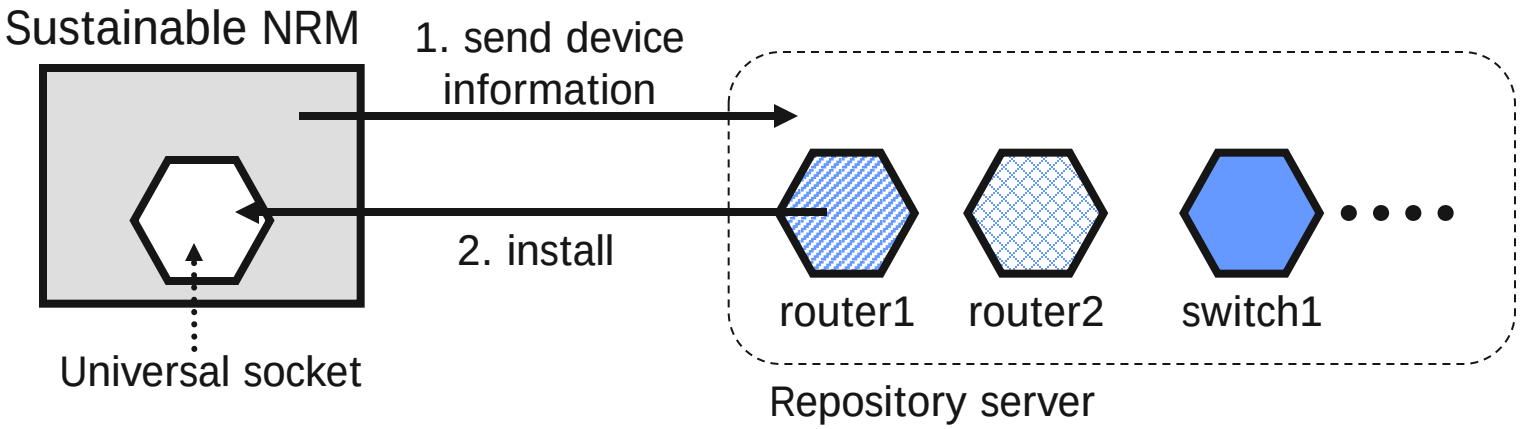
Sustainable NRM



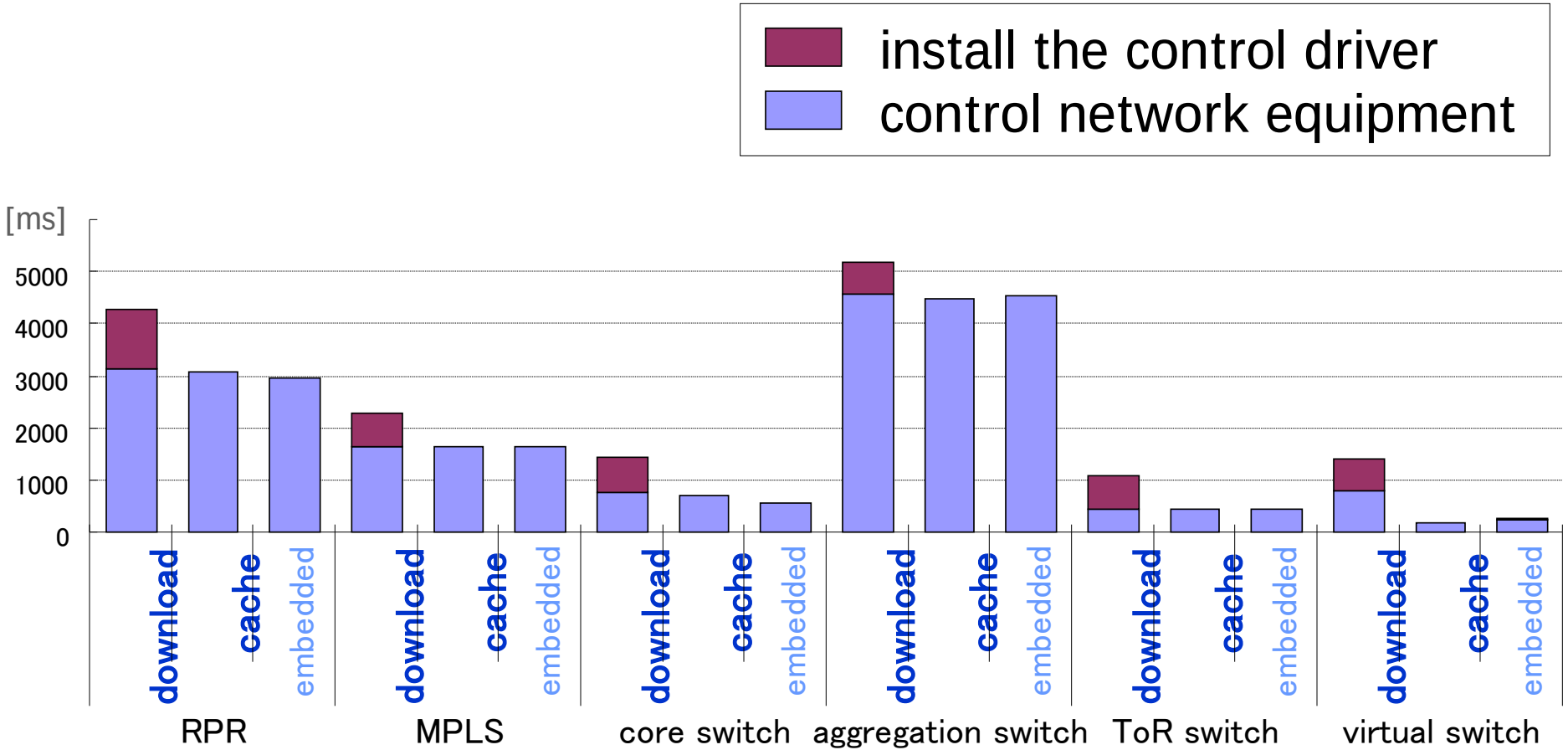
Control drivers are developed **independently**.

CHAMELEON software architecture

- CHAnging MEchanism of software moduLE based on the cONtext (CHAMELEON)
  - Install control drivers
    - without any modification of NRMs
    - under the operation of the NRM
  - Keep the control drivers as cache



Processing time to install and control



Proposed mechanisms

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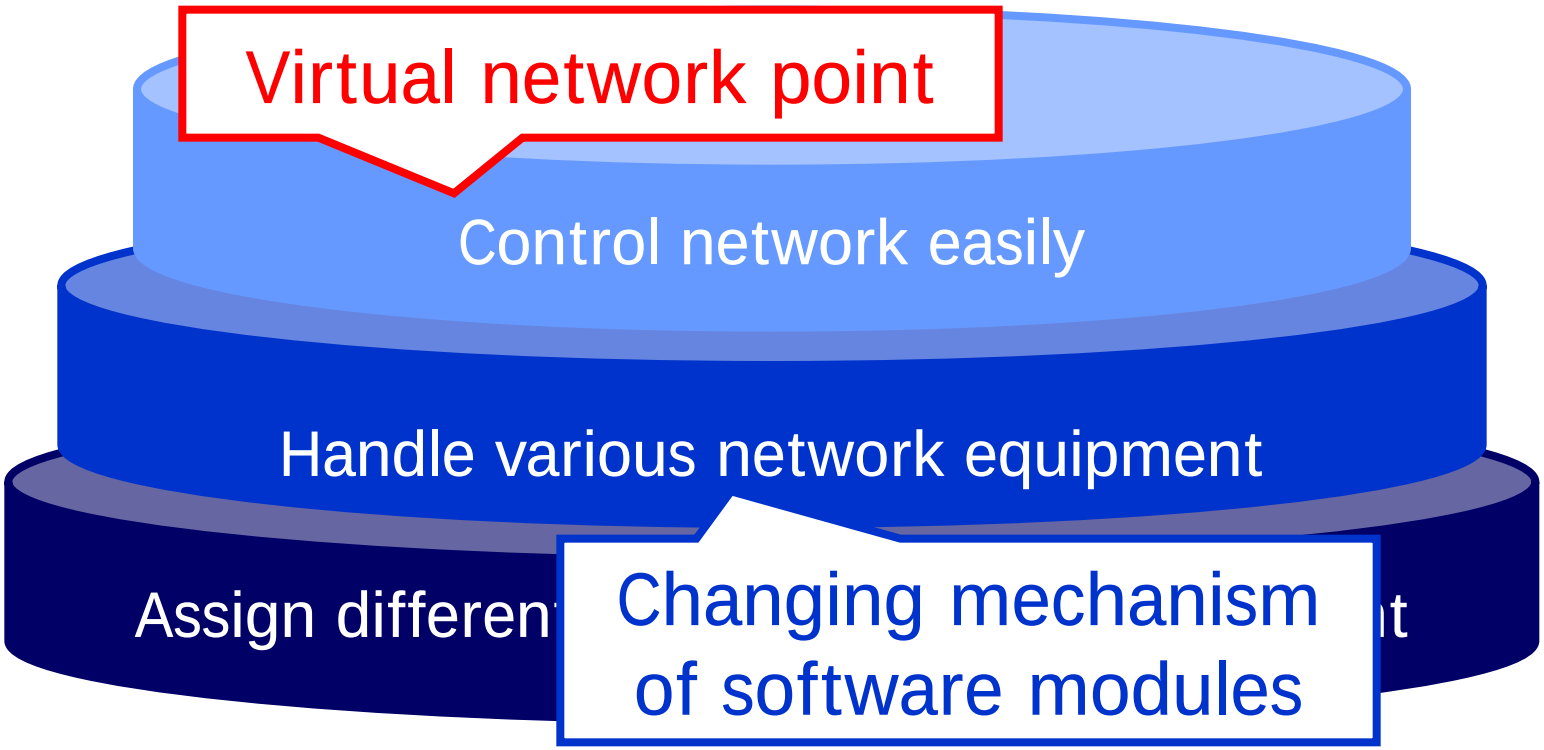
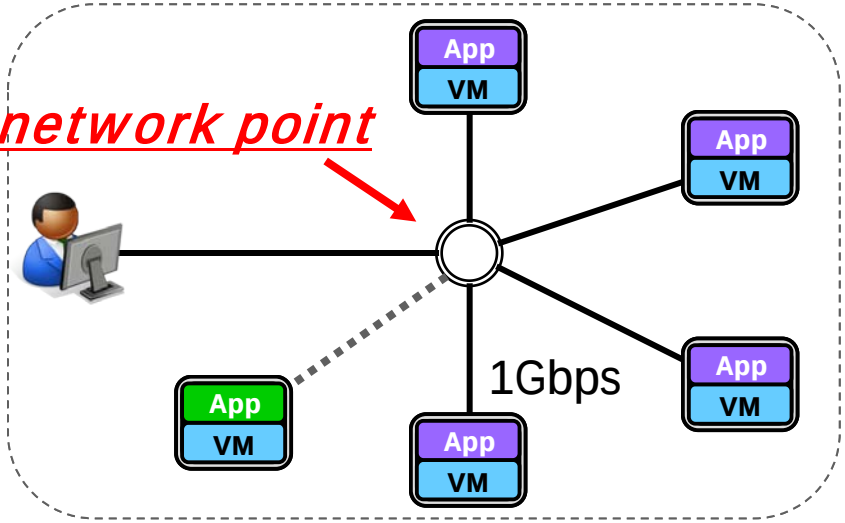
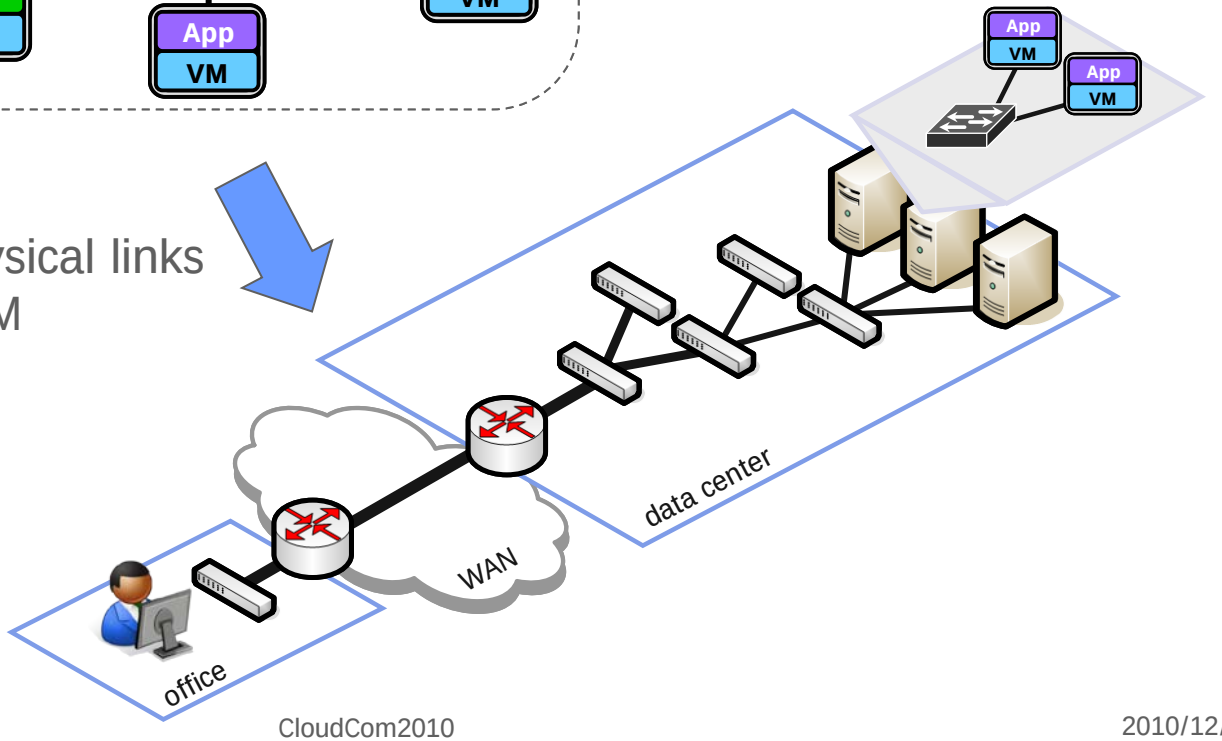


Virtual network point

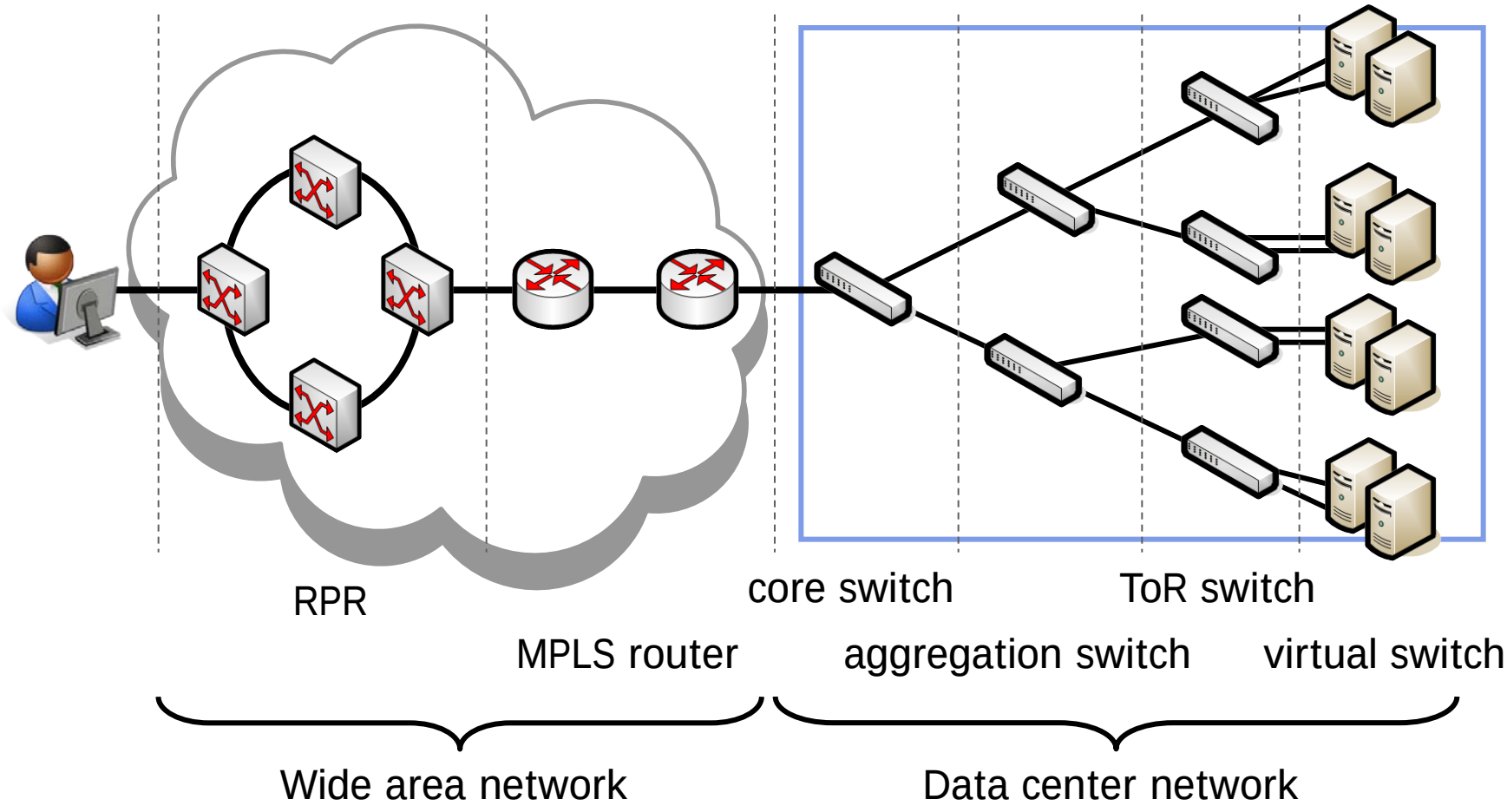
User view



Mapping to physical links
by NRM

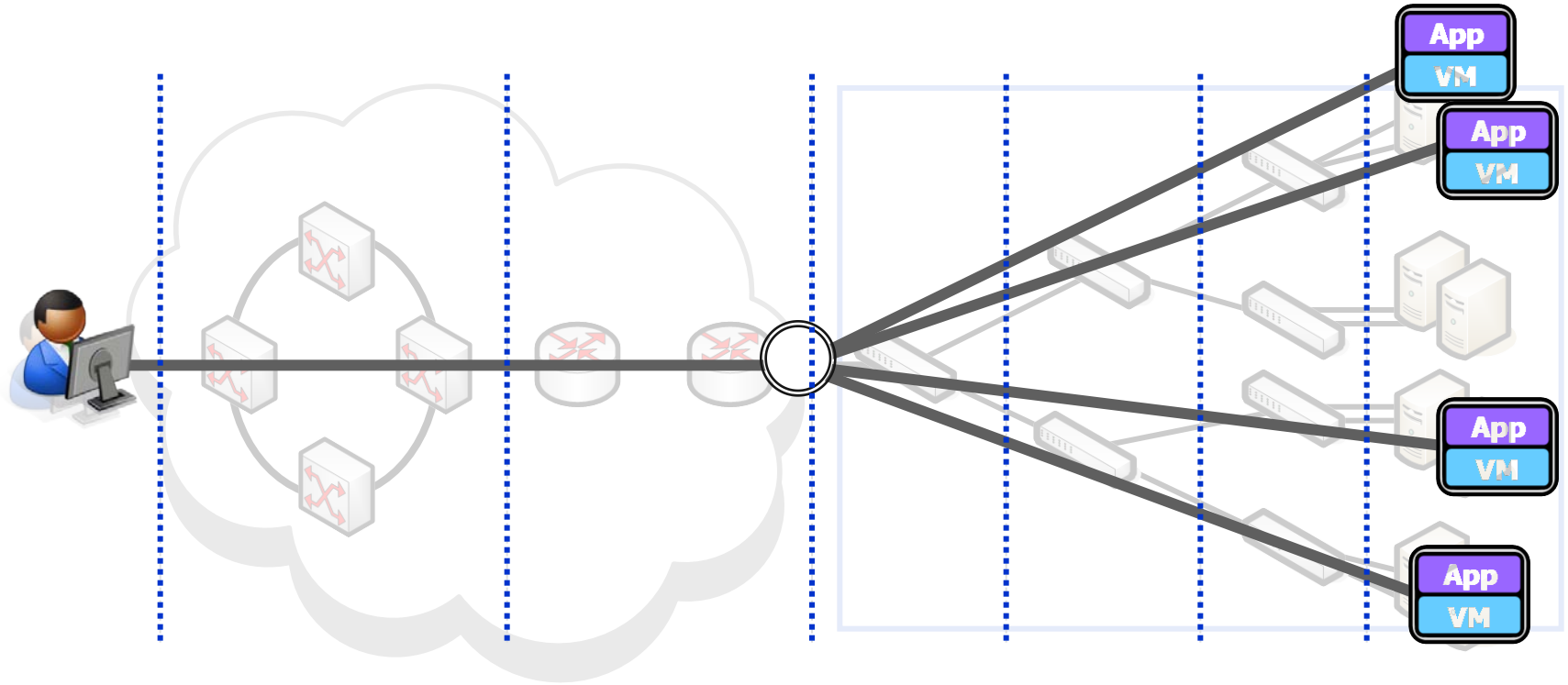


Tested network configuration



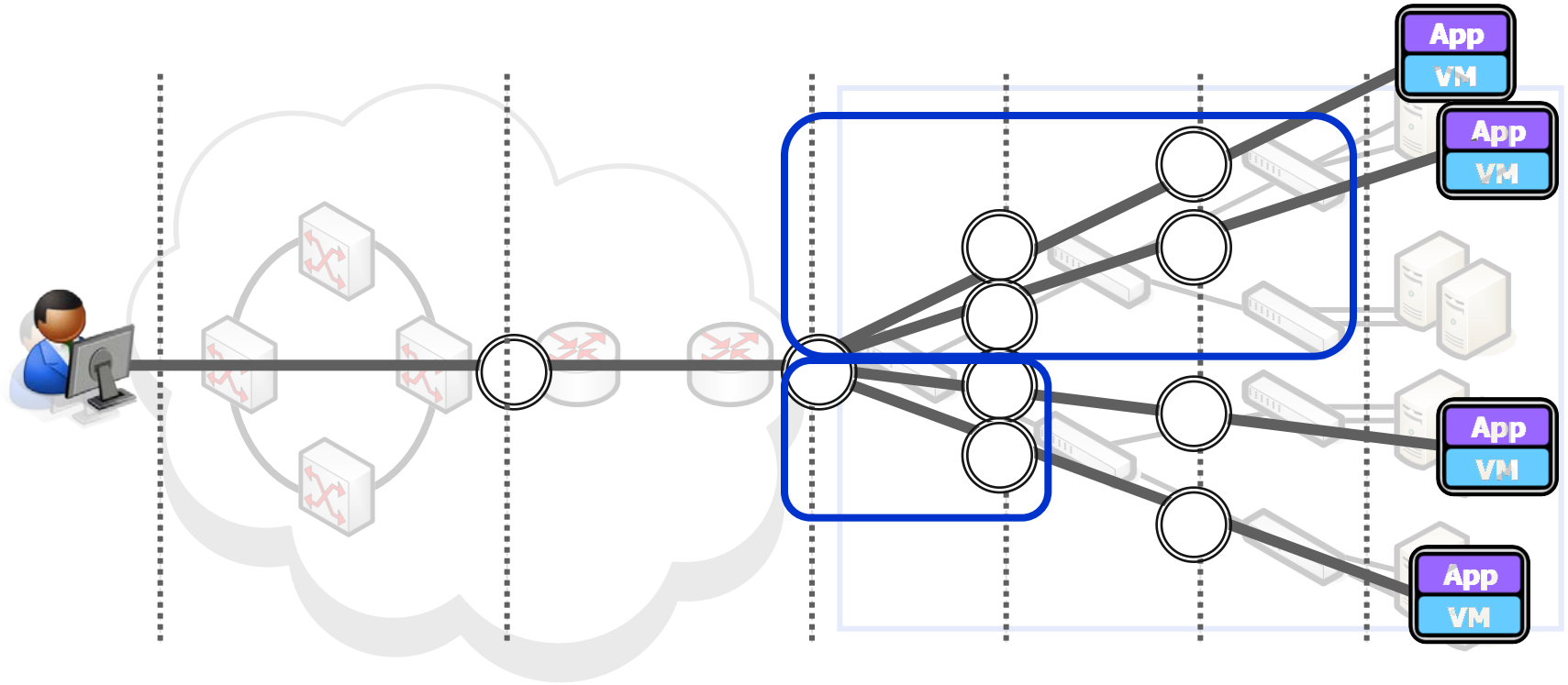
RPR: Resident Protection Ring
MPLS: Multiple Protocol Label Switching
ToR: Top of Rack

Mapping from virtual network point to physical links



Step1: Split logical links based on network domains

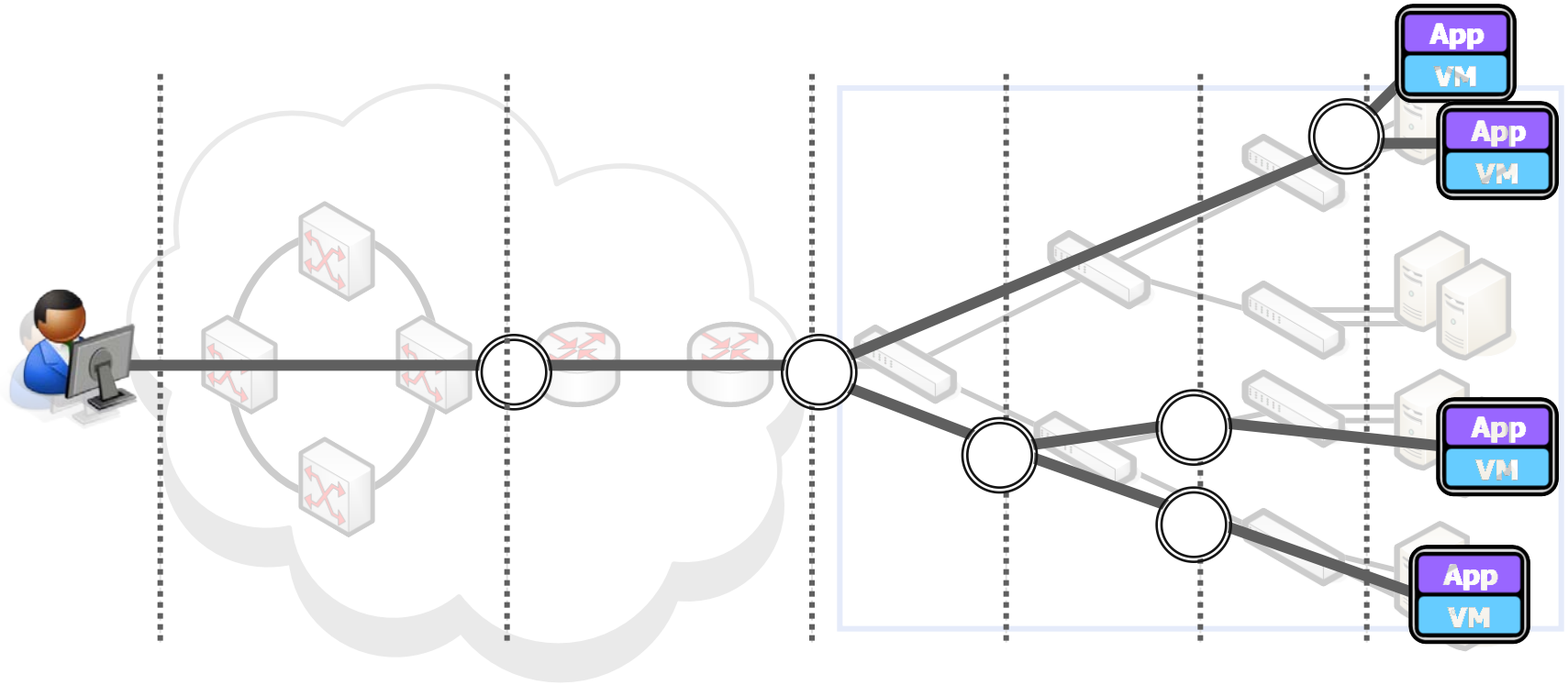
Mapping from virtual network point to physical links



Step1: Split logical links based on network domains

Step2: Aggregate logical links

Mapping from virtual network point to physical links



Step1: Split logical links based on network domains

Step2: Aggregate logical links

Conclusion

- Ideal virtual private clouds
  - Security isolation
  - Performance isolation

- Sustainable network resource management system
  - Handling various network equipment

    ⇨ **Changing mechanism of software modules**

  - Controlling network easily

    ⇨ **Virtual network point**

- Future works
  - Demonstration of performance isolation
  - Scalability evaluation of the proposed mechanisms