UNIVERSITAT POLITÈCNICA DE CATALUNYA

Contributions to Efficient Resource Management in Virtual Networks

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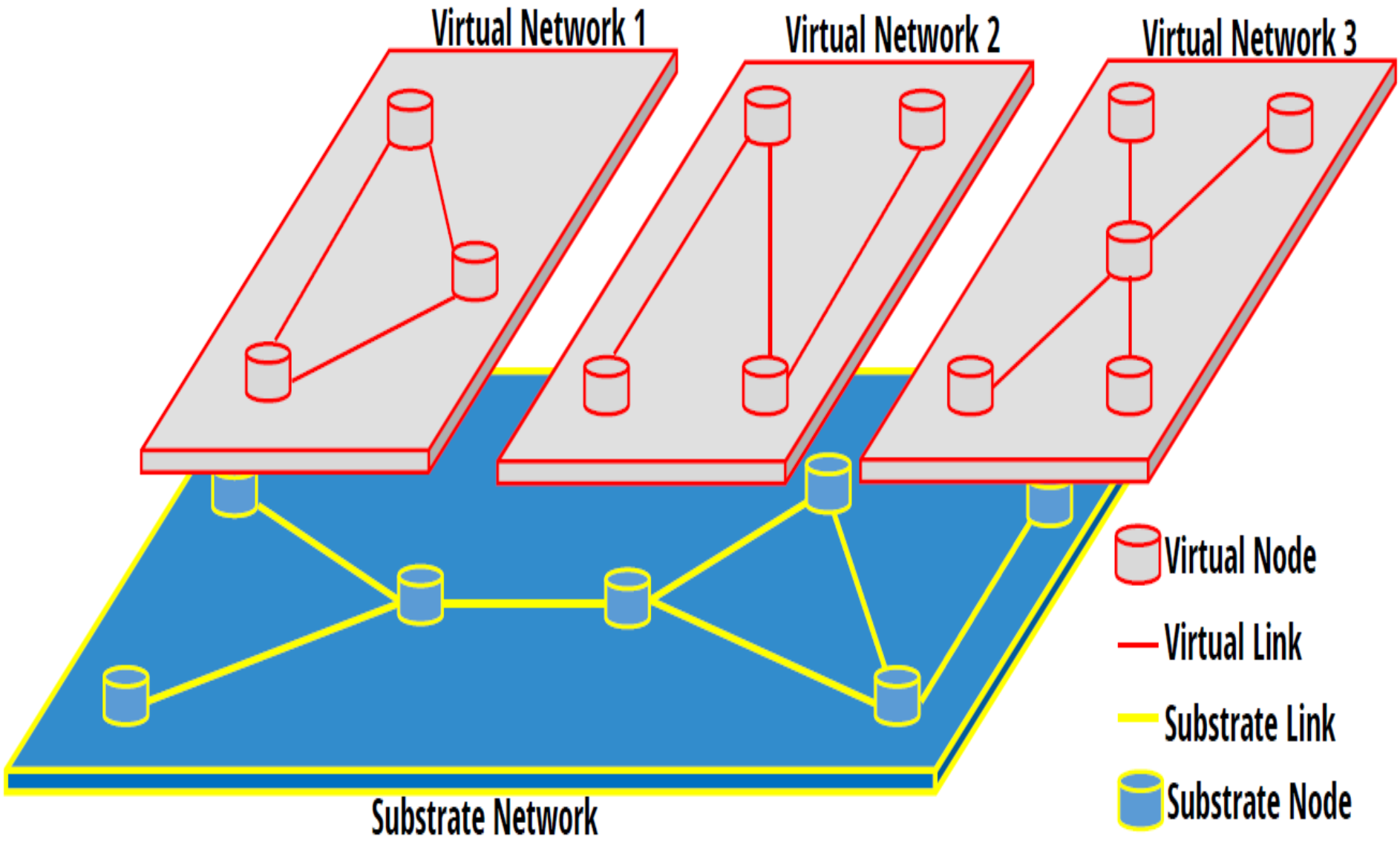
Presentation Outline

- Introduction
- Problem Description
- State of the Art
- Proposals
- Results
- Future Work

Introduction: Network Virtualisation

- **Definition:**
  - Abstraction between user and physical resources,
  - Role Separation: ISP = InP (for SNs) + SP (for VNs)
  - Multiple VNs can share same SN
  - A given VN can span multiple SN domains
- **Objective:**
  - Faster, dynamic, cheaper, customisable service and protocol stack deployment

Introduction: Network Virtualisation



Problem: Resource Management

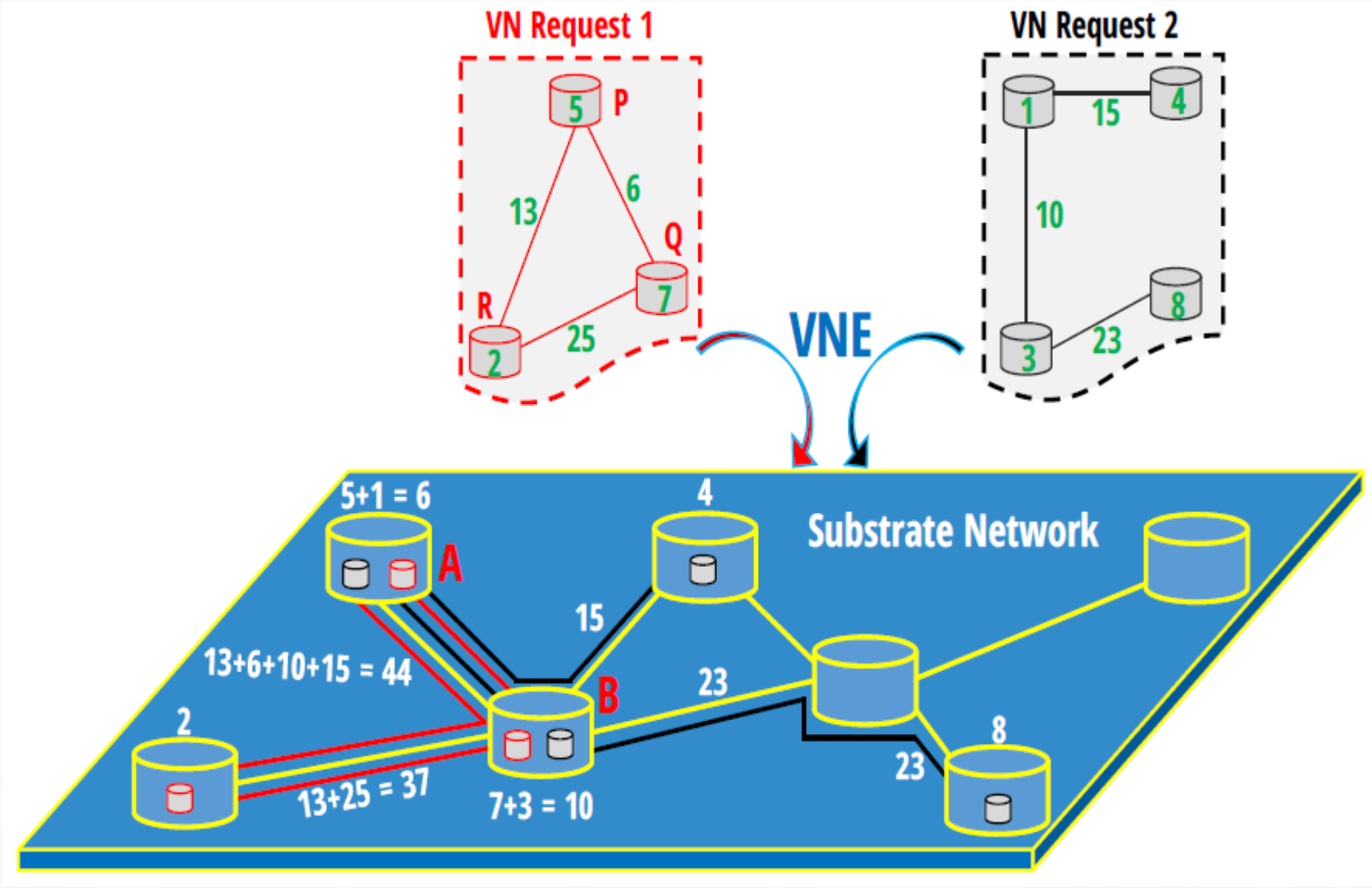
1 Virtual Network Embedding (VNE)

- Mapping virtual nodes/links to substrate nodes/links, subject to some constraints

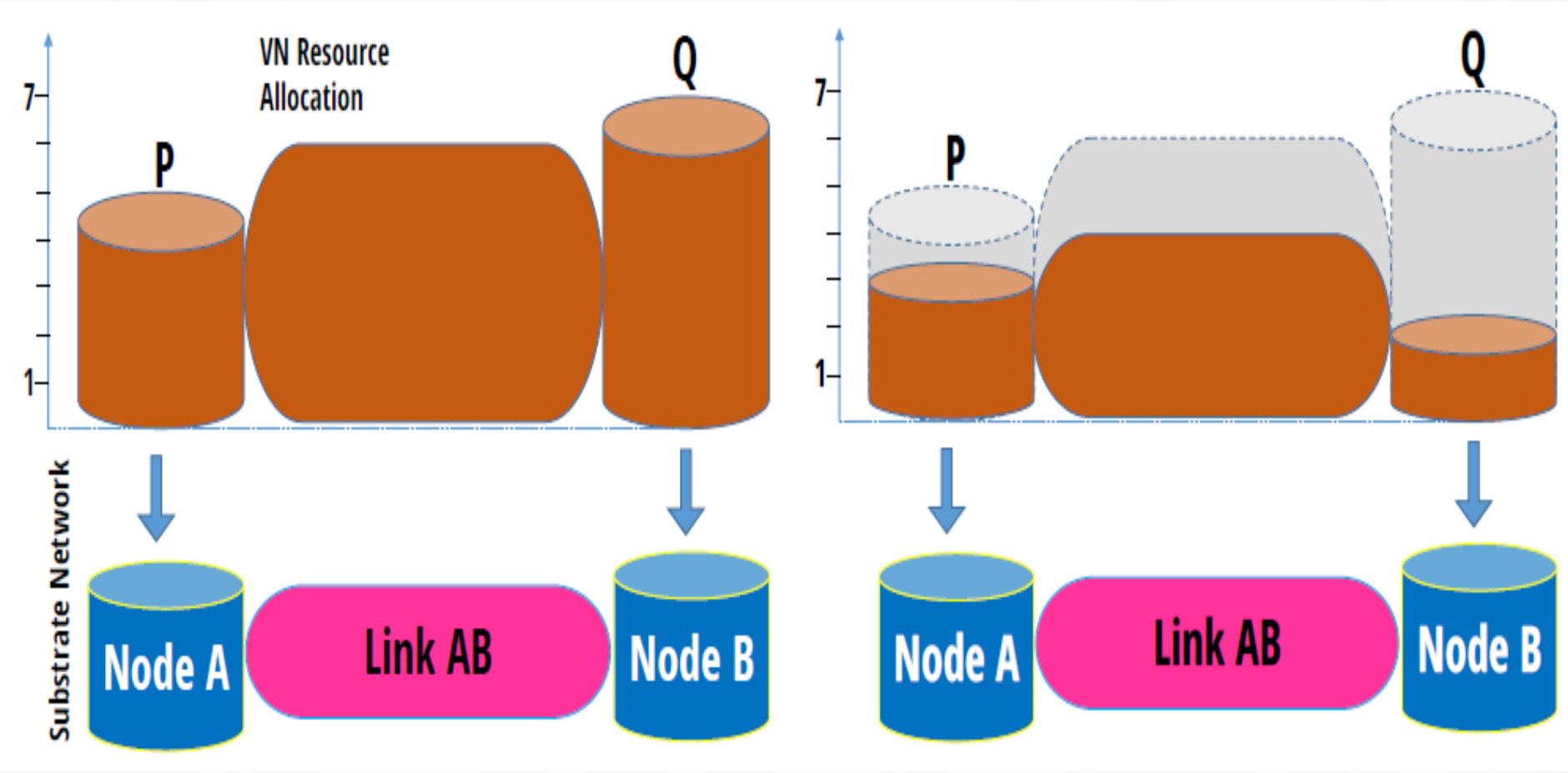
2 Dynamic Resource Allocation (DRA)

- Adapting virtual network resources allocations to actual utilisation

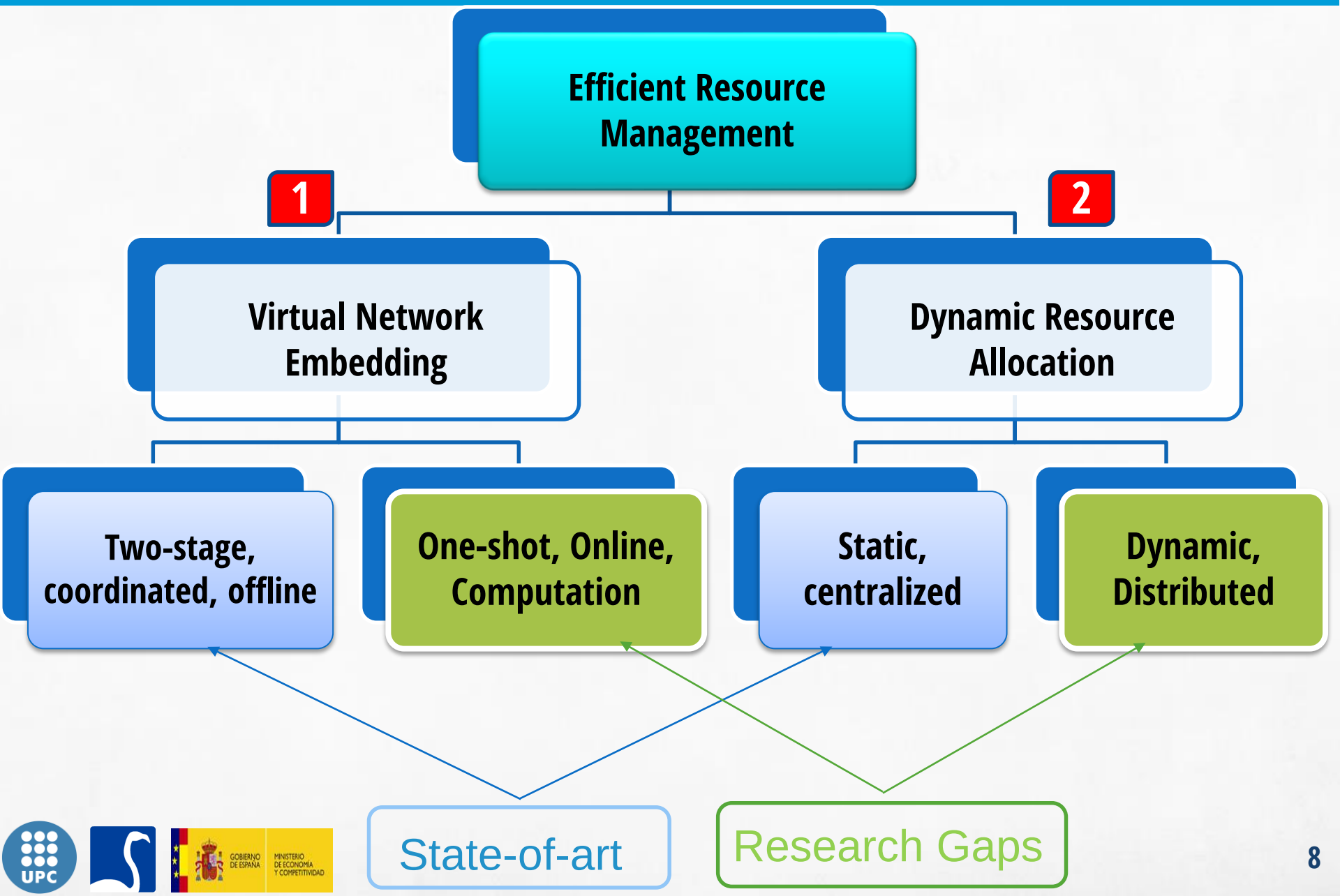
Problem: Virtual Network Embedding



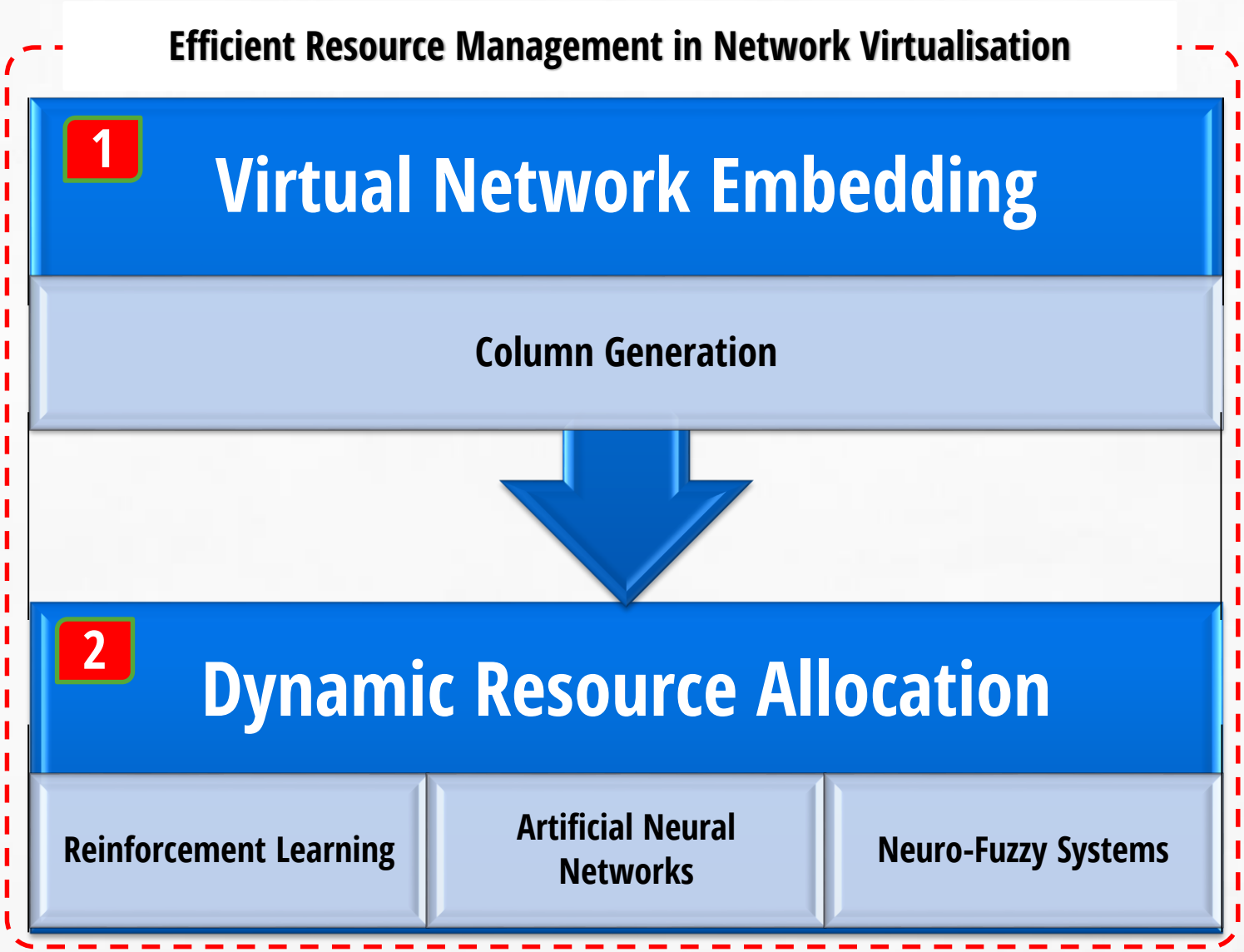
Problem: Dynamic Resource Allocation



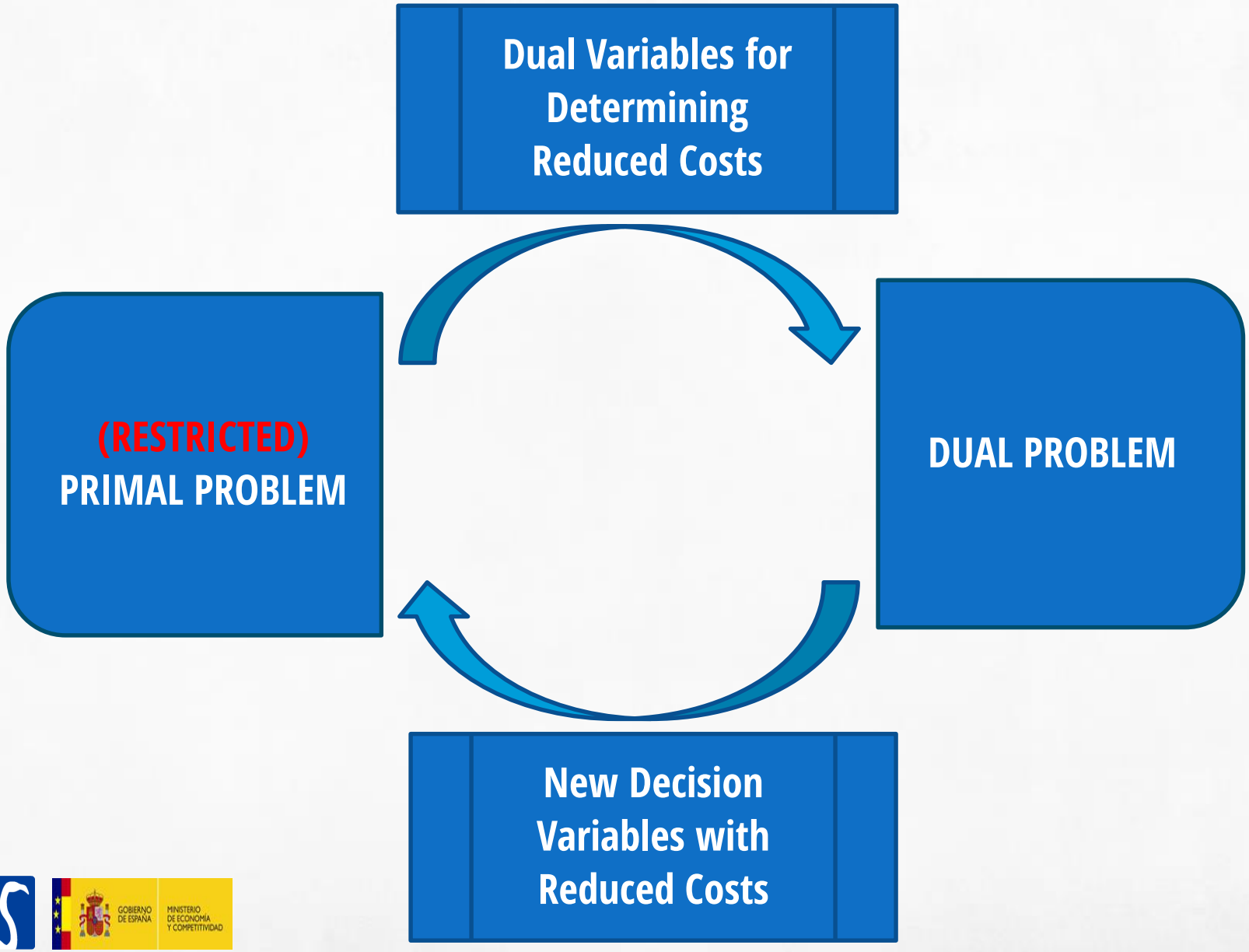
State of the Art



Research Contributions



Proposal I – Column Generation-based VNE



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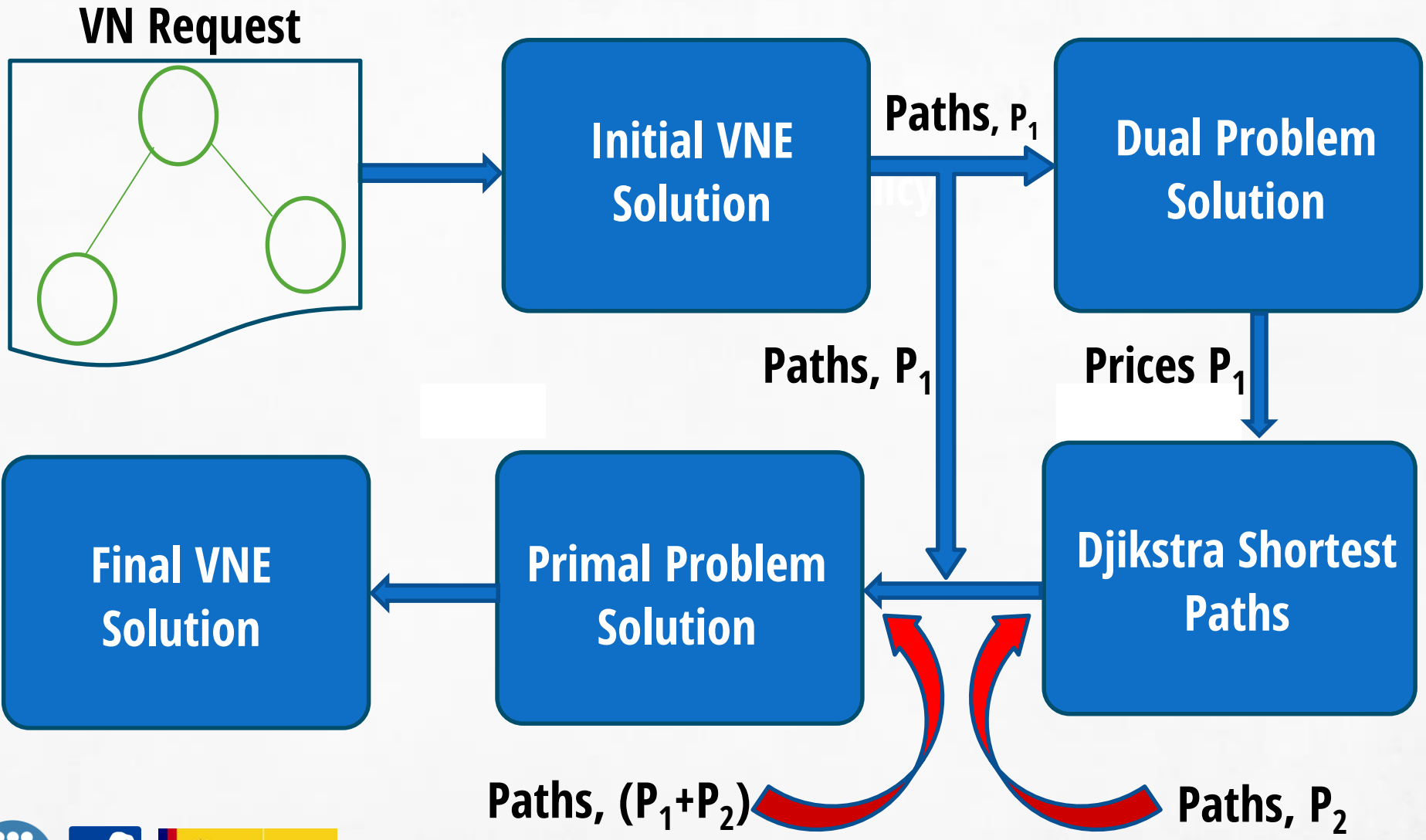
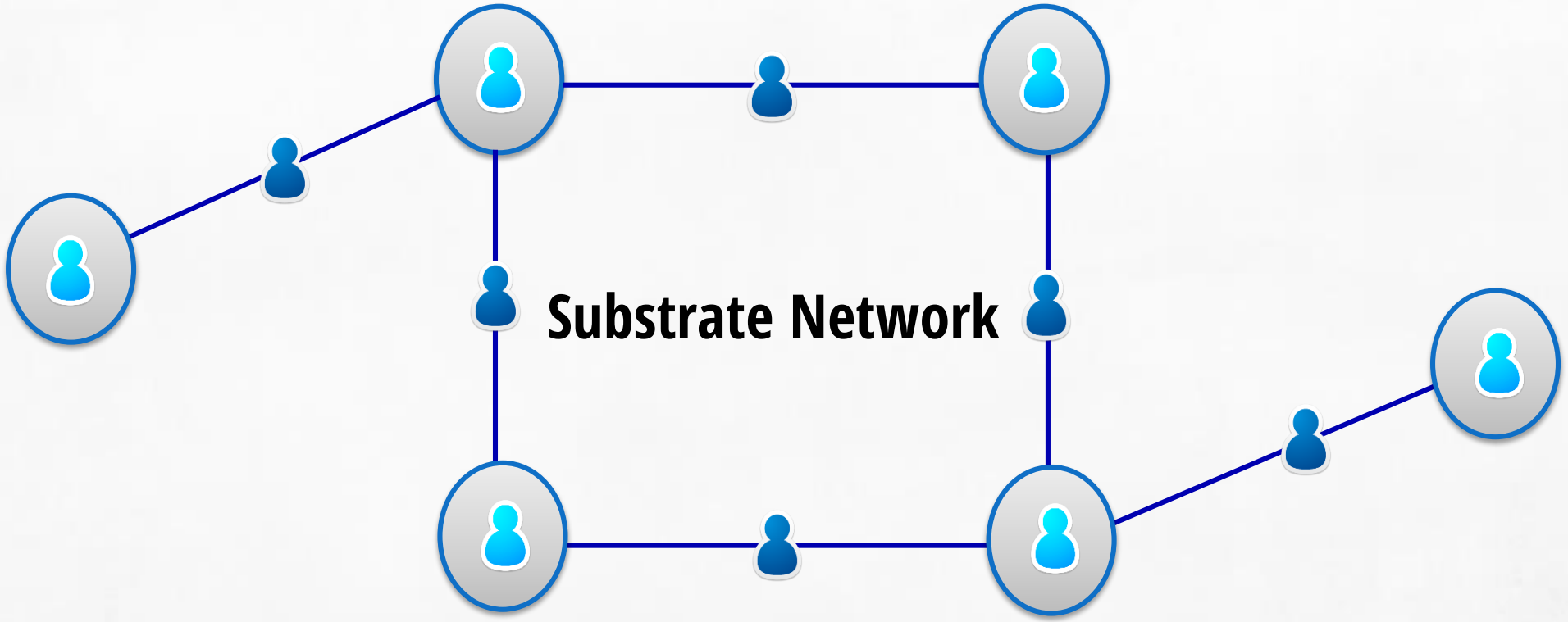


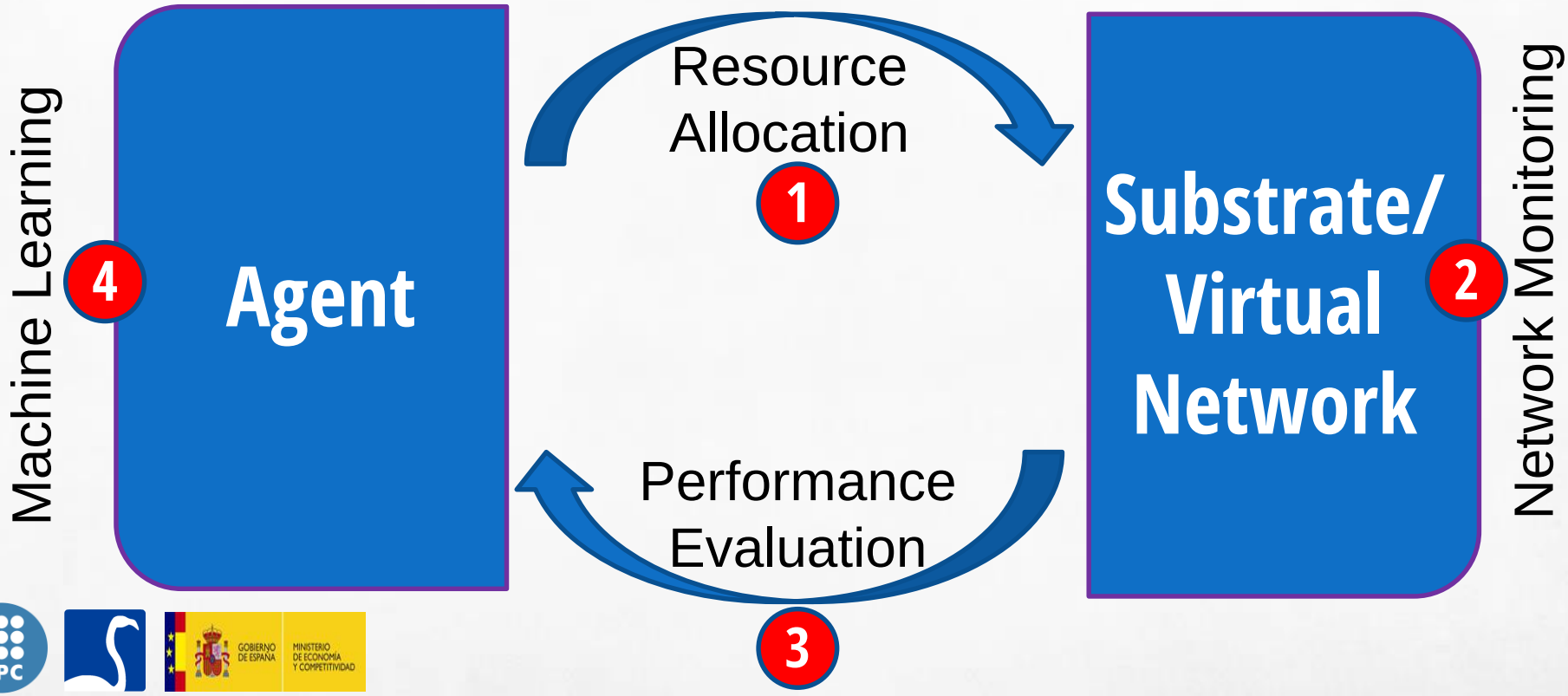
Proposal II – Learning-based DRA

- Distributed, Dynamic Resource Allocation
- Each Substrate Node/Link represented by Agent



Proposal II – Learning-based DRA

1. Reinforcement Learning,
2. Artificial Neural Networks,
3. Neuro-fuzzy Systems



Results

- **Virtual Network Embedding:**
  - One-shot virtual network embedding improves virtual network acceptance ratio,
  - Column generation enhances the time complexity of the one-shot virtual network embedding problem
- **Dynamic Resource Allocation:**
  - Adaptive and opportunistic use of virtual resources lead to better resource utilisation,
  - The improved resource utilisation is not at the expense of QoS to the virtual networks

Future Work

- **Virtual Network Embedding:**
  - Further enhance the computational complexity: relaxation
- **Dynamic Resource Allocation:**
  - Improve performance at beginning: offline step
- Extending ideas to other closely related fields: SDN and NFV
- Validation: Flamingo NoE

Thank You

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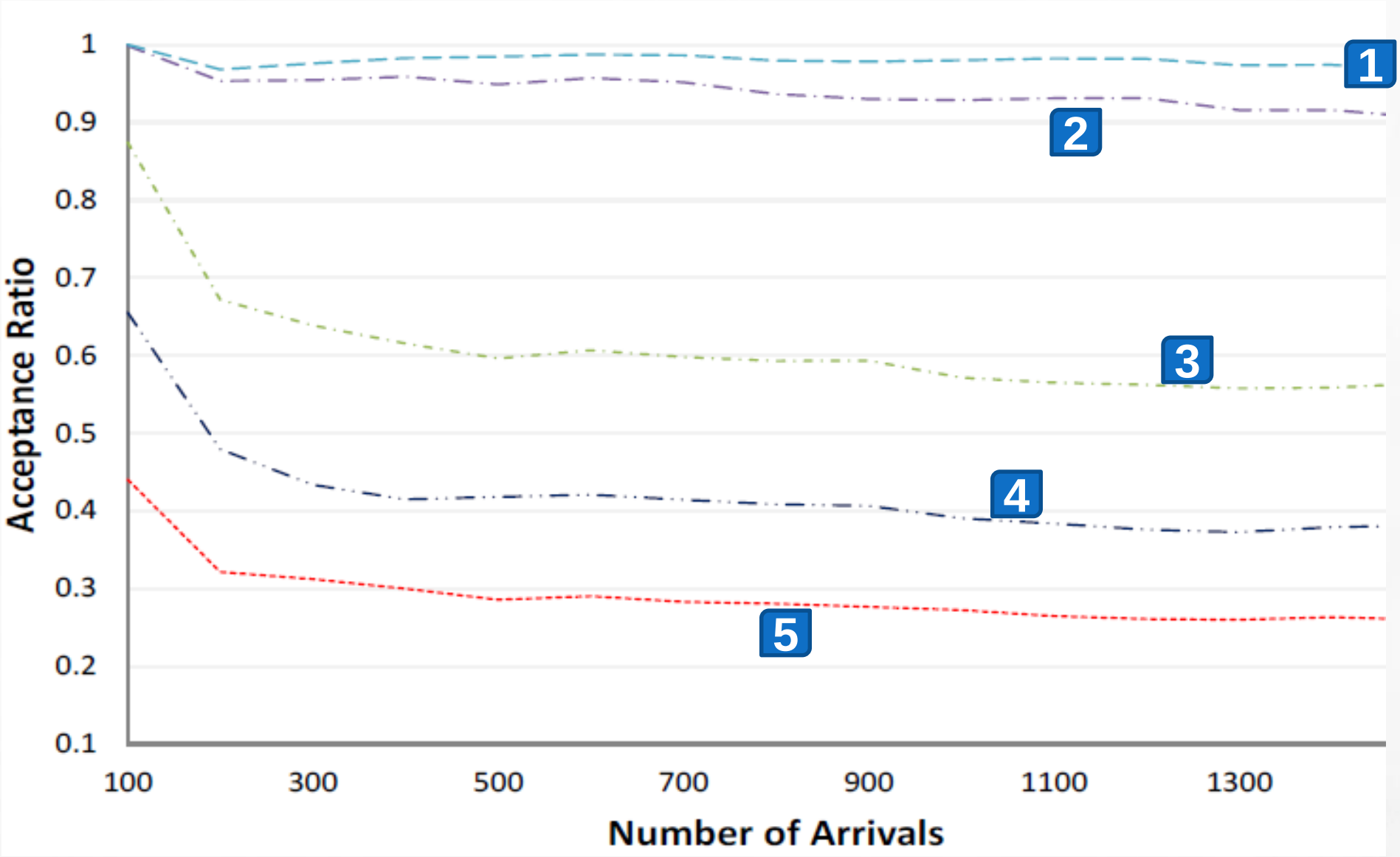
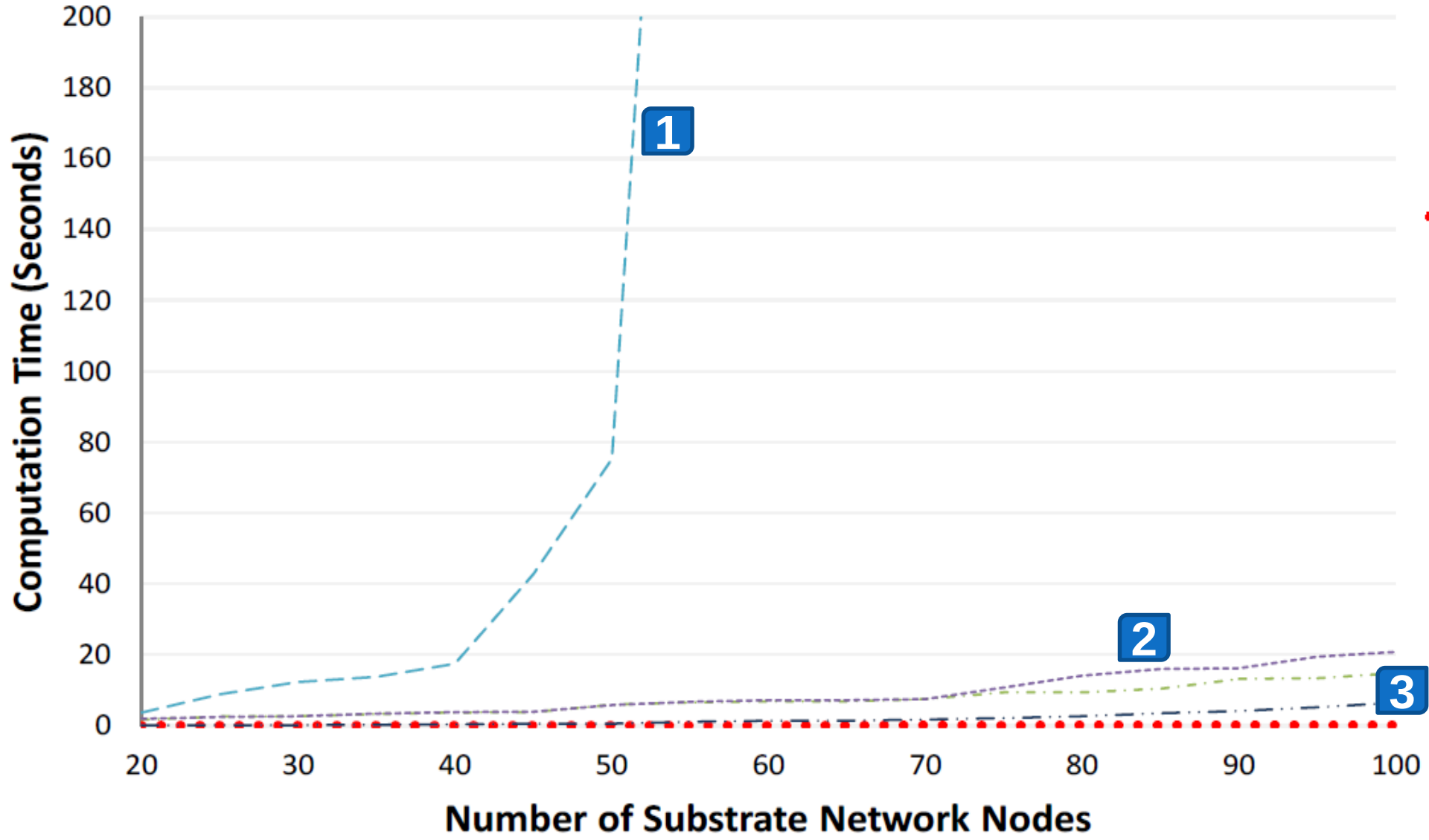
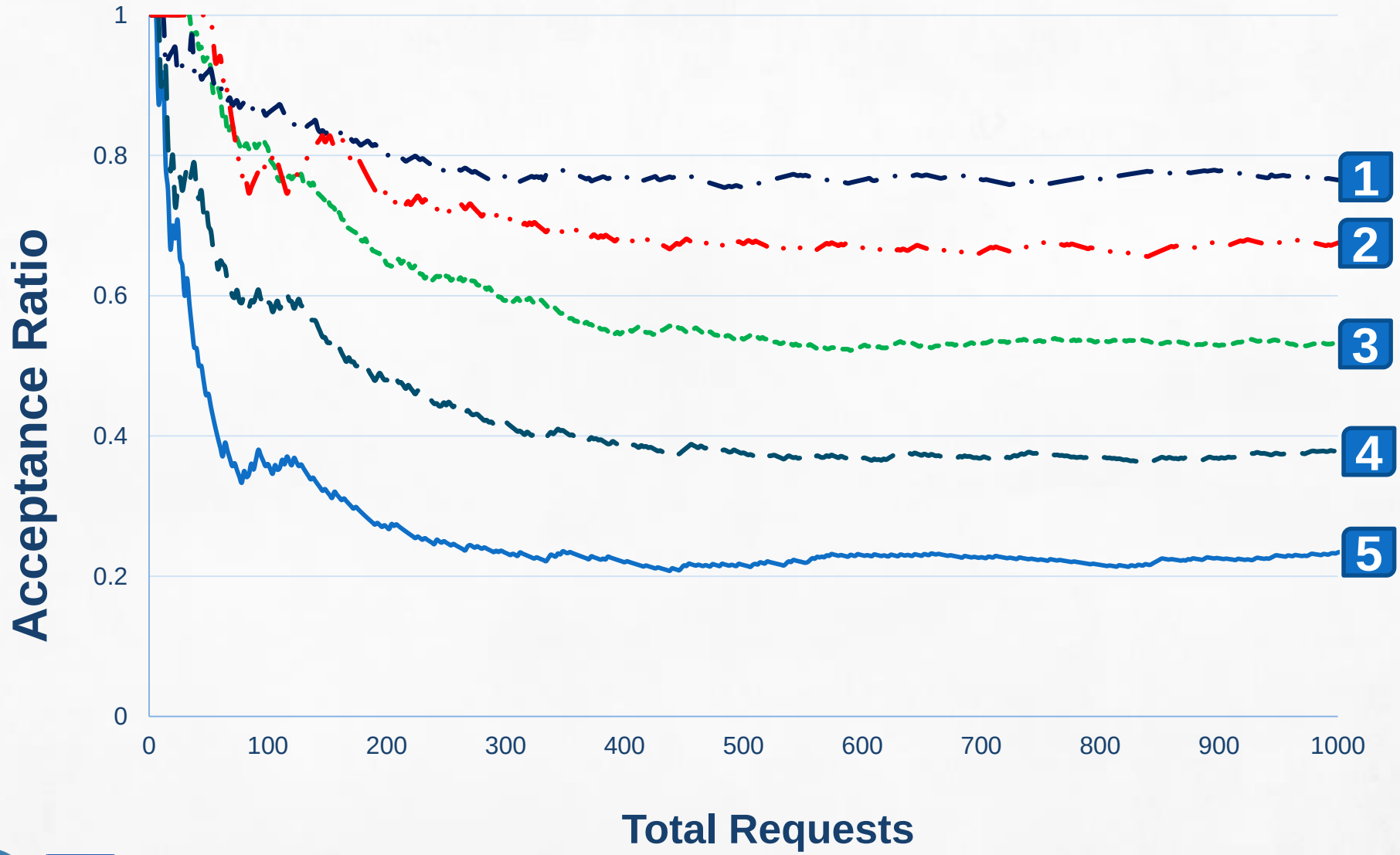
Results: Effect of Column Generation (I)



Results: Effect of Column Generation (II)



Results: Effect of proposed Learning in DRA



Results: Effect of proposed Learning in DRA