

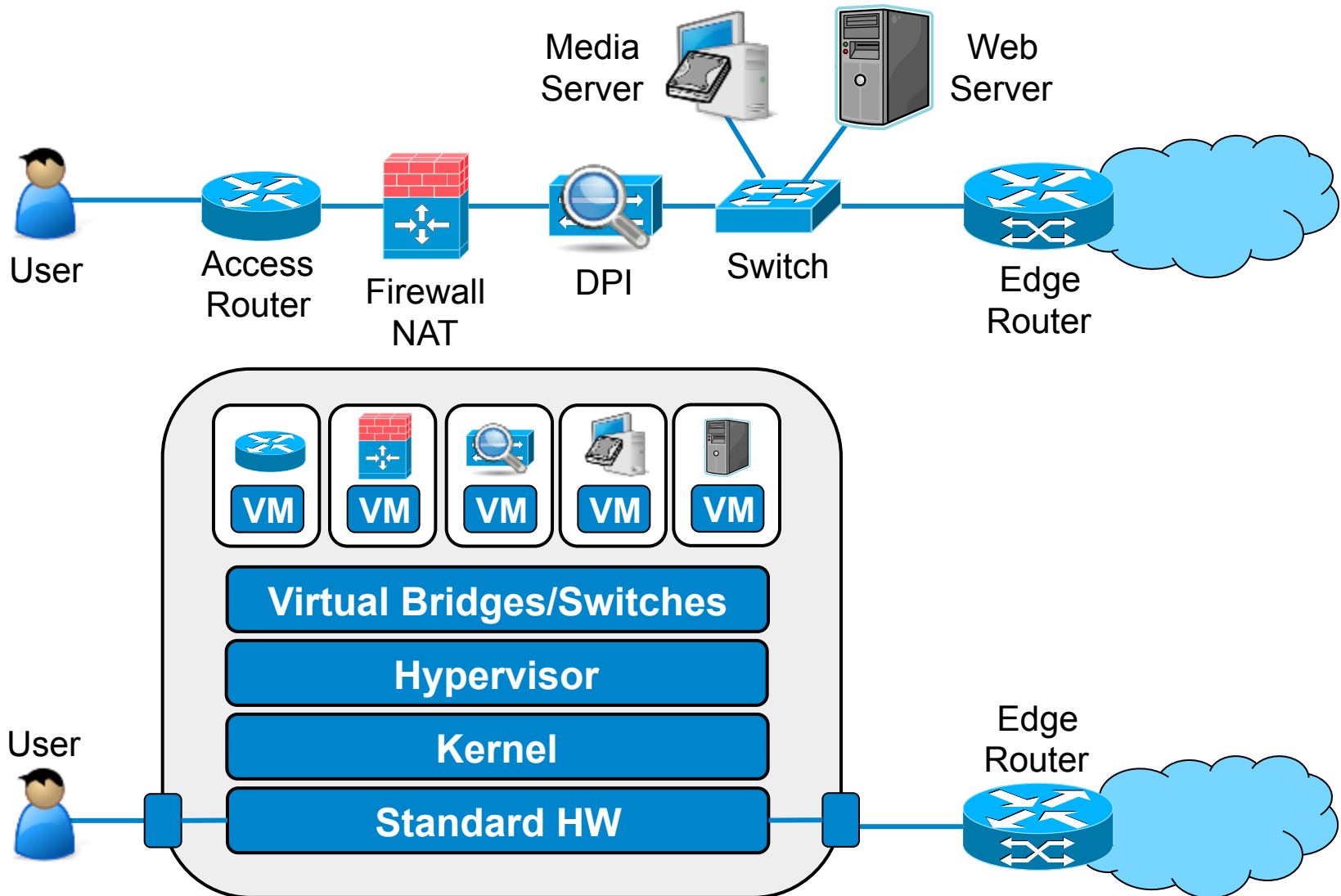


ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA

# **Applicare Constraint programming all'orchestrazione dei Service Function Chaining con Intent Programming**

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# Network Function Virtualization (NFV):



# Problem statement

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- Set of elements with attributes that will be use to identify a possible problem solution
  - Domains, links, VNFs
- Goal
  - Service Function Chain
    - List of elements that satisfy constraints

# Domain

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- Domain attributes
  - Name (domain ID)
  - SDN enabled (Y/N)
  - Capacity (number)
    - The maximum number (or sum of weights) of active VNFs that a domain may support

- VNF (Virtual network Function)
  - ID (unique name)
  - Type (equivalent to the color in the slide)
    - This is a string that summarize the function implemented
  - Terminating (Y/N)
    - The traffic flow to the VNF is forwarded further or not
  - Path Sensitive (Y/N)
    - If the traffic flow is bidirectional (back and forth) and the forward traffic goes through the VNF then the backward traffic must go through the same VNF
  - Mirrored (Y/N)
    - Two VNF are needed at the boundary of a network segment (if the VNF is present at an edge of a network segment it has to be present also at the other edge)
  - Weight (number)
    - Used to compare VNFs that perform the same function in different domains or in the same domain
  - Active (Y/N)
    - Says whether the VNF is already switched on or whether it is available but has to be switched on (meaning there will be a start up time to wait for)

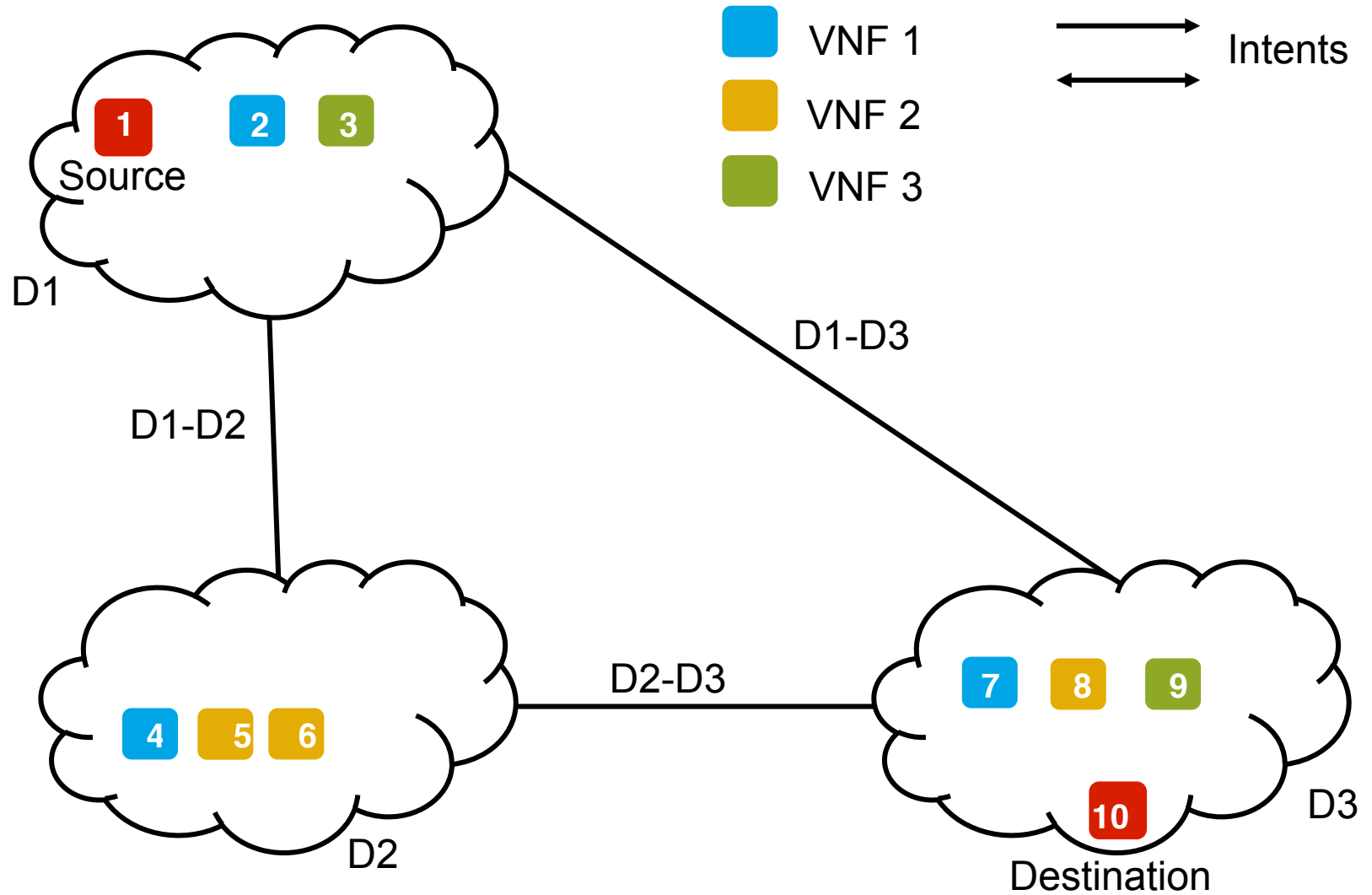
- Edges of the graphs
  - Domain 1
    - The source domain
  - Domain 2
    - The destination domain
  - Weight
    - Used to compare alternative equivalent paths
  - Available capacity
    - Used to determine whether a link can be used by an intent which requires a minimum capacity

# Goal




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- Service specification
  - Endpoints
    - Source(s) and destination(s)
  - Interactive/distribution
    - The information flow is bidirectional or monodirectional?
- Goal specific constraints
  - Chain
    - Ordered sequence of the VNFs required by the service (service template)
  - QoS (number)
    - Says whether the service has some specific QoS requirements coded in a number
  - Others
    - Proximity, domain preferences

# Example





- DPI (terminating) 
  - 1 (D2) weight 1      5
  - 2 (D2) weight 2      6
  - 3 (D3) weight 2      8
- WANA (path sensitive, mirrored) 
  - 1 (D1) weight 1      2
  - 2 (D2) weight 1      4
  - 3 (D3) weight 1      7
- SHAPER 
  - 1 (D1) weight 2      3
  - 2 (D3) weight 1      9

# Example

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- 3 Domains
  - D1 (SDN enabled, capacity 6)
  - D2 (SDN enabled, capacity 8)
  - D3 (SDN enabled, capacity 10)
- 3 Edges
  - D1-D2 (weight 2, capacity 1)
  - D1-D3 (weight 3, capacity 1)
  - D2-D3 (weight 2, capacity 1)

# GOAL

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- Set up 3 services in sequence
  - Service 1
    - From endpoint in D1 to endpoint in D3
    - Requires DPI, WANA
    - WANA should be in D1 close to of source and destination
  - Service 2
    - From endpoint in D1 to endpoint in D3
    - Requires SHAPER
    - SHAPER should not be in D3
  - Service 3
    - From endpoint in D1 to endpoint in D3
    - Requires SHAPER