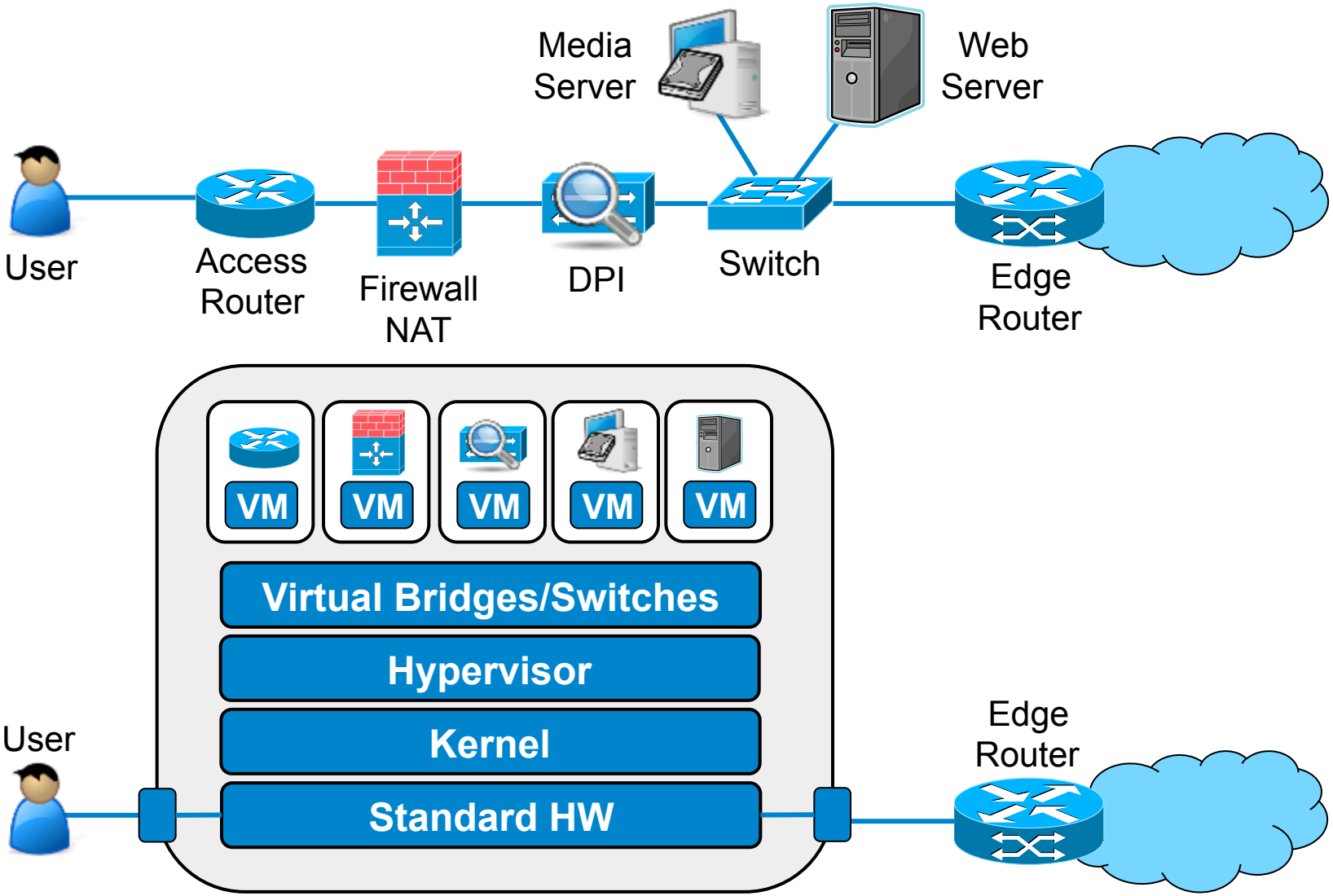
ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

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

Network Function Virtualization (NFV):



Problem statement

- 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

- 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

- 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 alredy switched on or whether it is available but has to be switched on (meaning there will be a start up time to wait for)

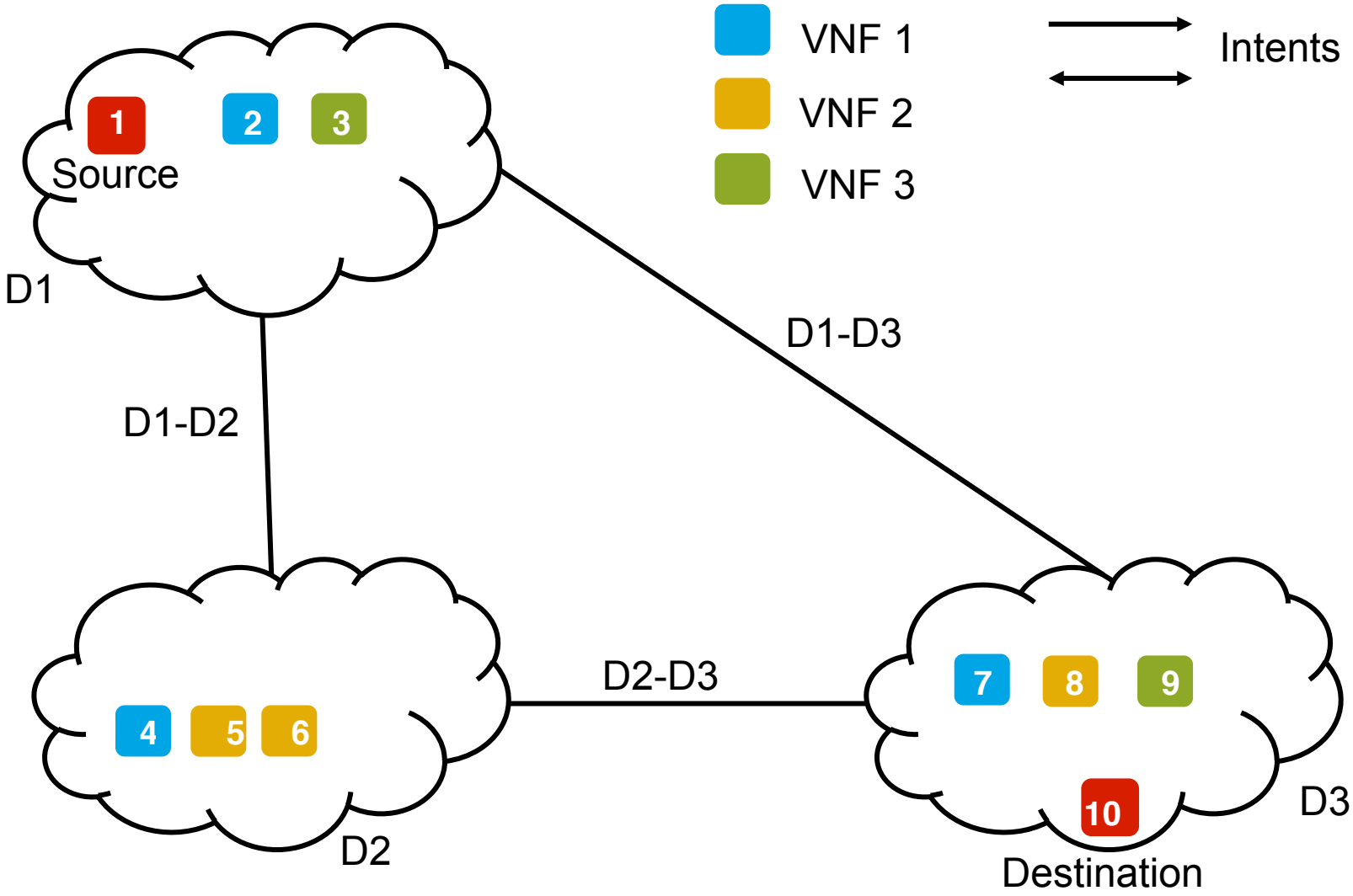
Links

- 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

- 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 requierements coded in a number
  - Others
    - Proximity, domain preferences

Example


VNF 1
VNF 2
VNF 3
Intents
1
2
3
Source
D1
D1-D2
D1-D3
4
5
6
D2
D2-D3
7
8
9
10
Destination
D3

VNF

- 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

- 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

- 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