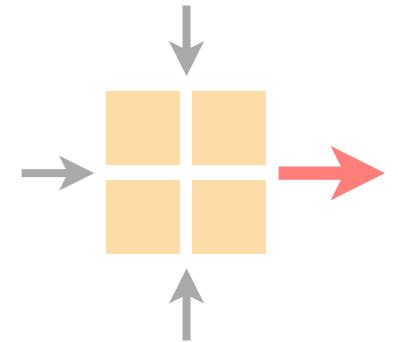


# Advanced Topics in Communication Networks

## Internet Routing and Forwarding



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27 Oct 2020

Lecture starts at 14:15

Subsets of the materials inspired and/or coming from Olivier Bonaventure

# Behind the scene...



Last week on  
**Advanced Topics in Communication Networks**

MPLS-based  
Traffic Engineering

Quality of Service

RSVP-TE  
(at long last)

How do we manage congestion?  
(locally, on a per link basis)

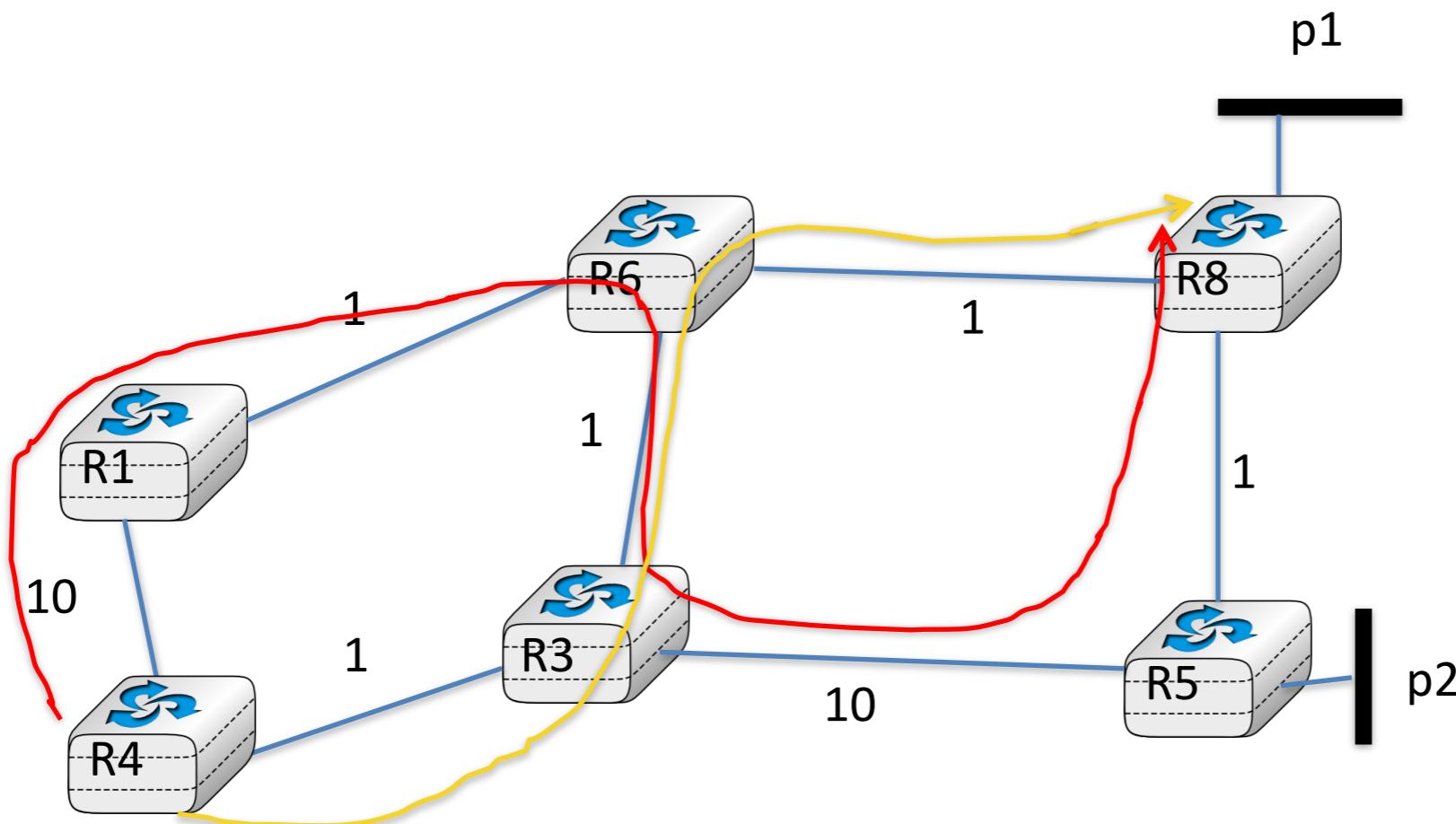
MPLS-based  
Traffic Engineering

Quality of Service

RSVP-TE  
(at long last)

# MPLS-based Traffic Engineering

- How to create LSPs along a non-shortest path ?



# RSVP (2)

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- Principles of operation
- Two important RSVP messages
  - **PATH**
    - used by sender to inform routers and receivers of the new flow and its required resources
      - no resources are reserved due to reception of PATH
  - **RESV**
    - used by receiver to actually reserve resources for the flow specified in the PATH message
      - resources are reserved for the IP packets sent by the sender towards the receiver along the path taken by the PATH message
  - RSVP messages are sent inside IP packets

# Using RSVP to distribute MPLS labels

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- Principle
  - RSVP supports downstream on-demand label allocation
    - RSVP extension for MPLS called RSVP-TE
  - Ingress LSR sends PATH message towards egress LSR
    - PATH message includes Label Request Object
  - Egress LSR sends label back in RESV message
    - RESV propagates the labels hop-by-hop

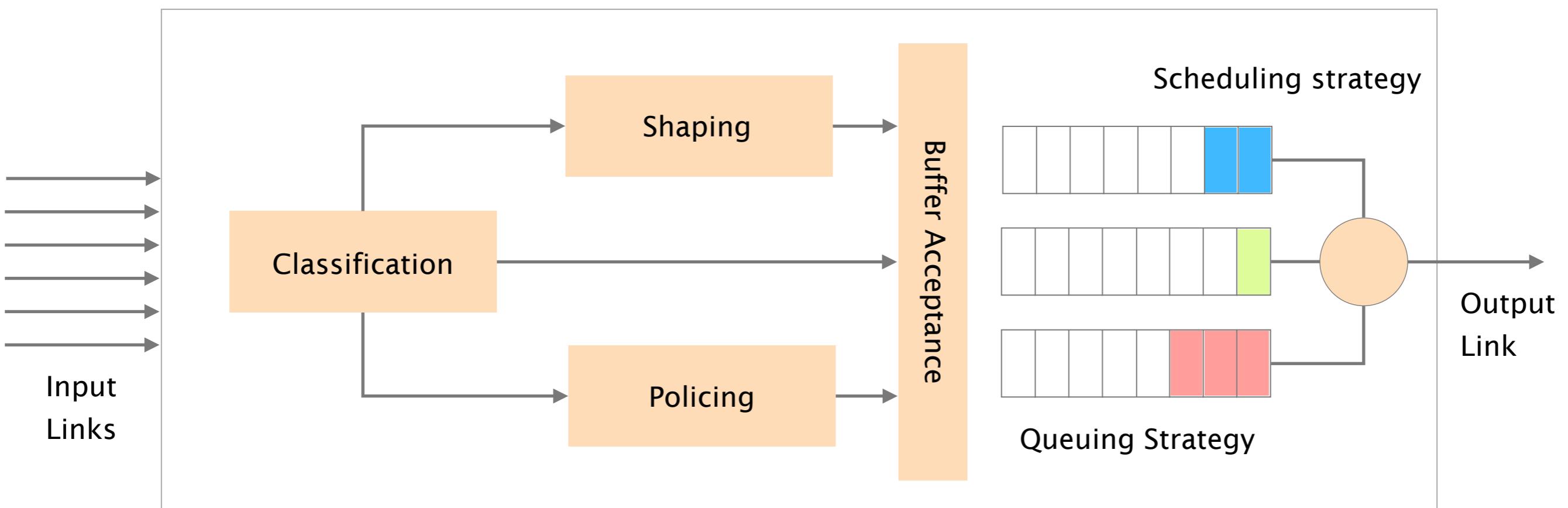
MPLS-based  
Traffic Engineering

Quality of Service

How do we manage congestion?  
(locally, on a per link basis)

We started to explore the different ways to manage congestion

QoS-enabled router



This week on  
Advanced Topics in Communication Networks

**Quality of Service**

How do we manage congestion?  
(locally, on a per link basis)

**VPN**

How do we interconnect private networks?  
(across a shared infrastructure)

**Quality of Service**

**VPN**

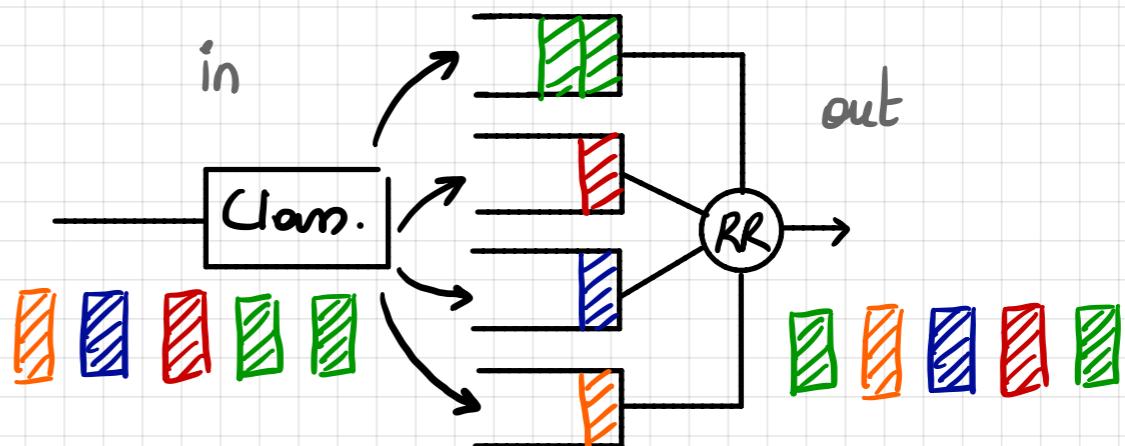
**How do we manage congestion?**  
**(locally, on a per link basis)**

Let's switch to  
04\_qos\_notes.pdf

I'm resuming from WFQ  
(page 5/19)

### c) (Weighted) Fair Queuing (FQ)

In FQ, incoming packets are classified into  $\neq$  flows and stored into a dedicated queue. A round-robin algorithm is then used to service all queues, so that they are served in a fair way.



**Quality of Service**

**VPN**

**How do we interconnect private networks?  
(across a shared infrastructure)**

Let's switch to  
05\_vpn\_notes.pdf

Advanced Topics in Communication Networks

L7: Virtual Private Networks / 27.10.2020

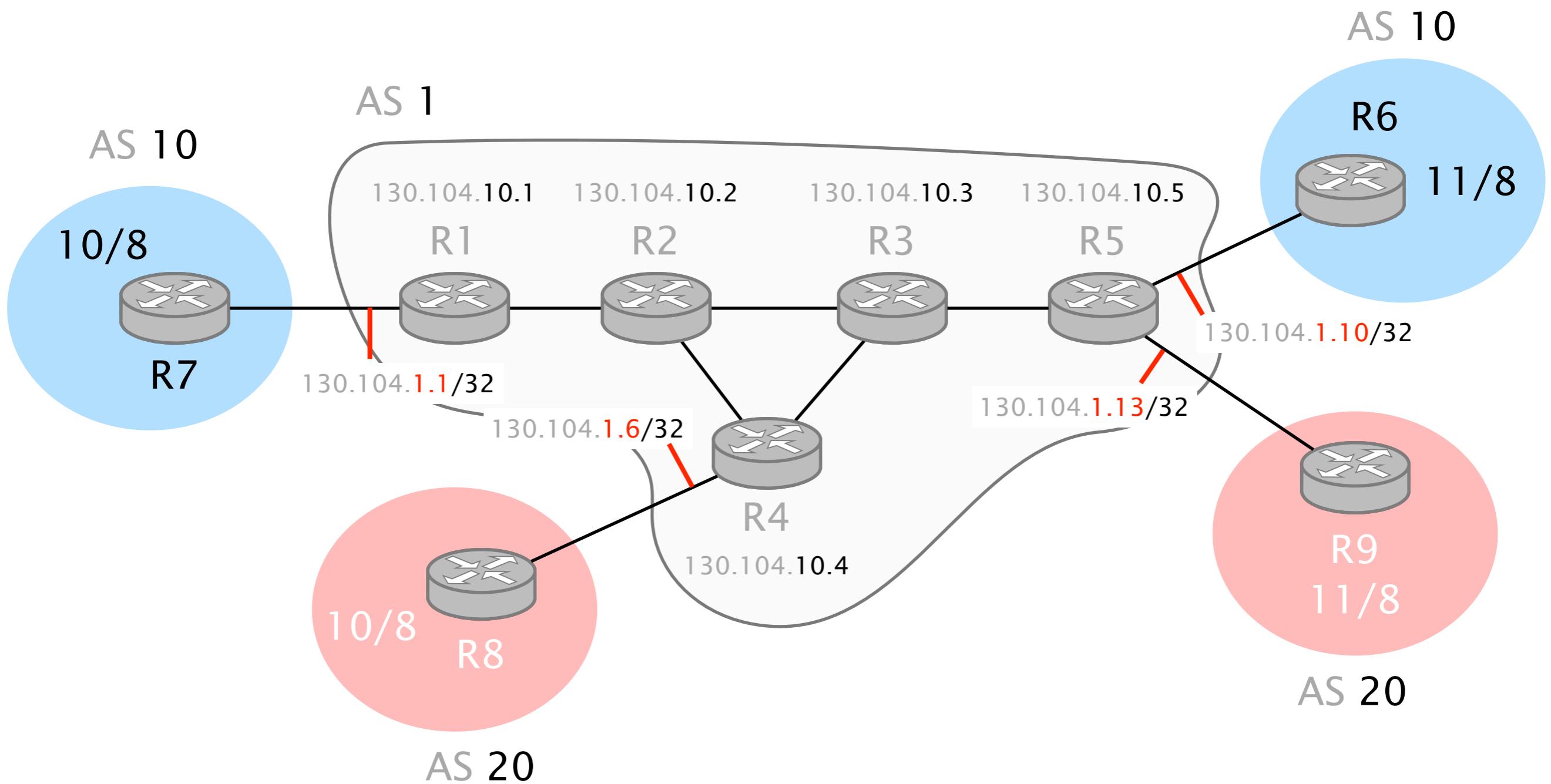
Prof. Laurent VANBEVER - nsp.ee.ethz.ch

The diagram illustrates a Virtual Private Network (VPN) architecture. At the center is a cloud labeled "Provider Network". Surrounding it are several other clouds representing different sites. Some sites are connected directly to the provider network via solid black lines, while others are connected via dashed lines. Two specific sites are highlighted with red outlines: "site 1 EPFL" and "site 2 EPFL". These two sites are also connected to each other via a dashed line. The other sites shown are "ETH zürich site 1", "UZH site 1", "UZH site 2", "ETH zürich site 2", and "ETH zürich site 3".

How do we provide a private network  
on top of a shared infrastructure?

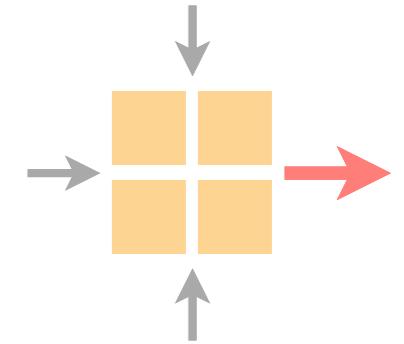
# Our lab for today

## One provider, 2 VPN clients with 2 sites each



# Advanced Topics in Communication Networks

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