BGP multi-homed

Wielodrogowość w BGP

- Celem zajęć jest zapoznanie się z zasadą działania wielodrogowości protokołu BGP (ang. *muli-homed* BGP) w przypadku więcej niż jednego dostawcy usług Internetowych (ang. Internet Service Provider, ISP)
- W ramach zajęć zostanie uruchomionych siedem ruterów BGP
- Rutery będą wstępnie przygotowane do pracy (konfiguracja sieciowa, częściowa konfiguracja BGP)
- Podczas zajęć należy:
  - Skonfigurować i zbadać równoważenie ruchu pomiędzy oboma ISP z użyciem prefix-list
  - Skonfigurować ruting wewnątrzdomenowy w jednym z systemów autonomicznych (ang. autonomous system, AS) i zbadać działanie sieci
  - Potwierdzić osiągalność adresu BGP next-hop oraz ocenić znaczenie takiej osiągalności dla prawidłowej propagacji prefiksów w BGP

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bgp: multi-homed

Version	2.0
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Description	configuration of a multi-homed network with backup and load sharing

Modified for the purpose of the IP Networks lab

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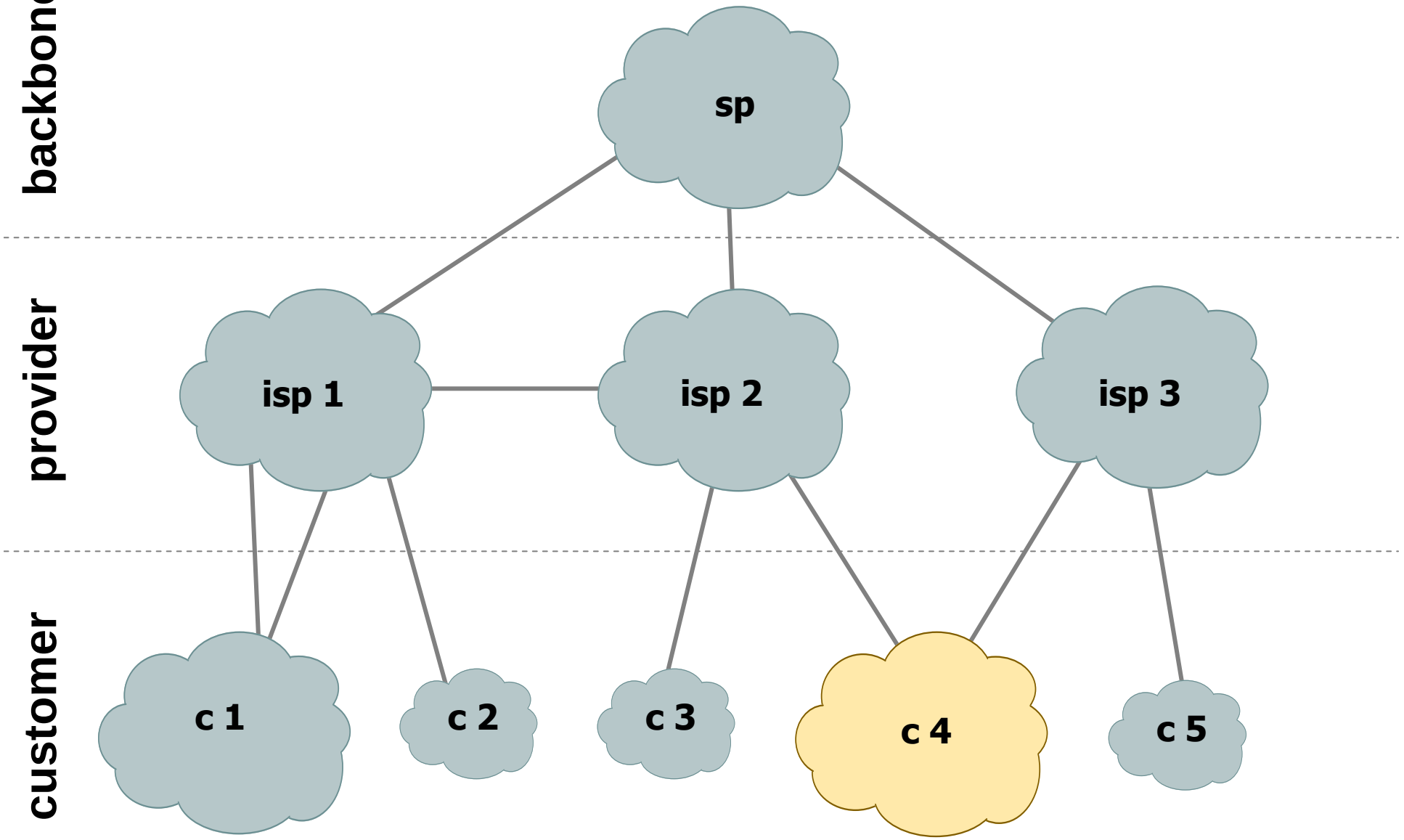
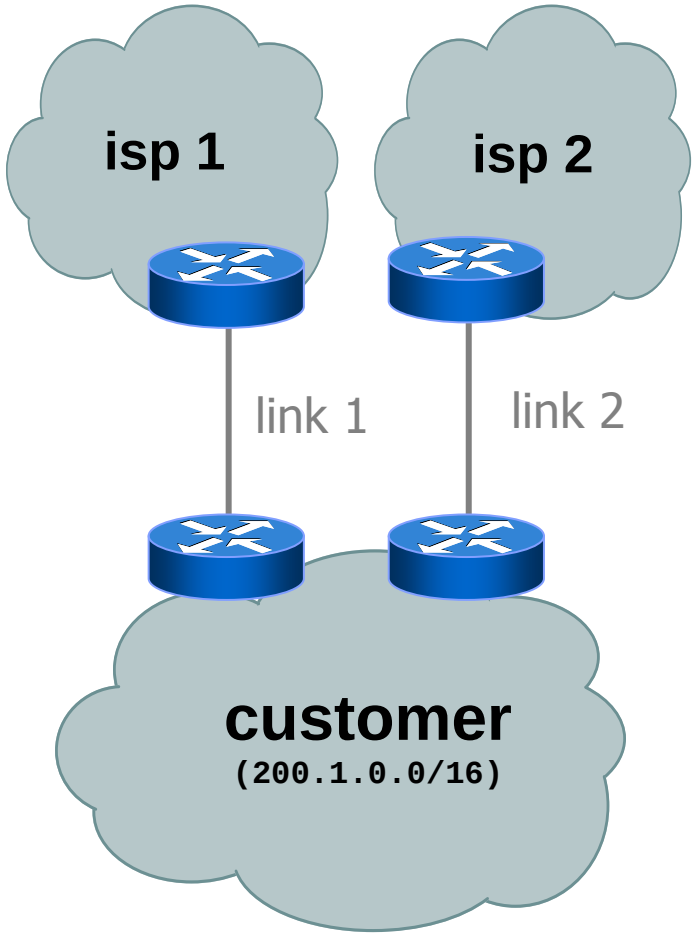
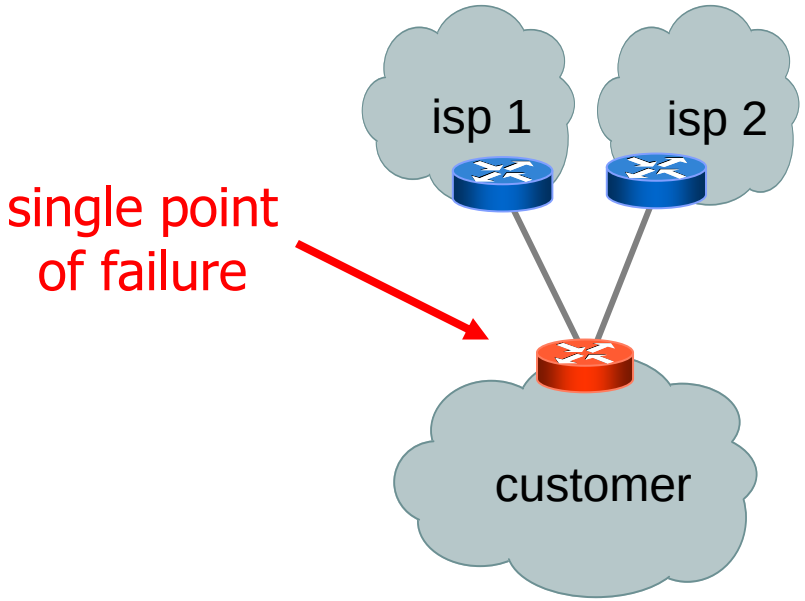
multi-homed network



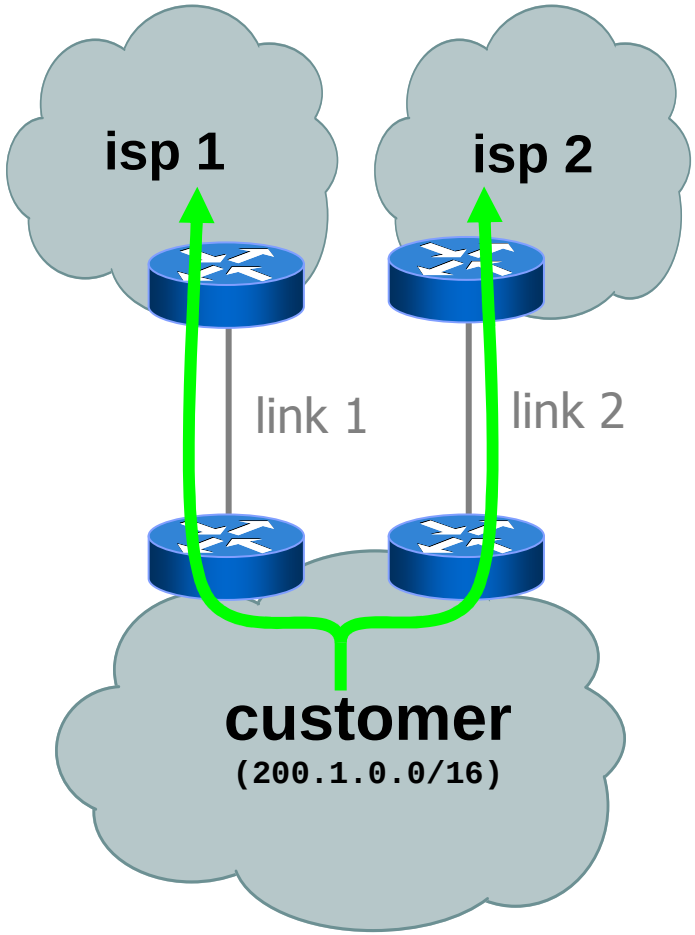
multi-homed network



- two links to two different providers
- generally two routers are involved in order to avoid single points of failures

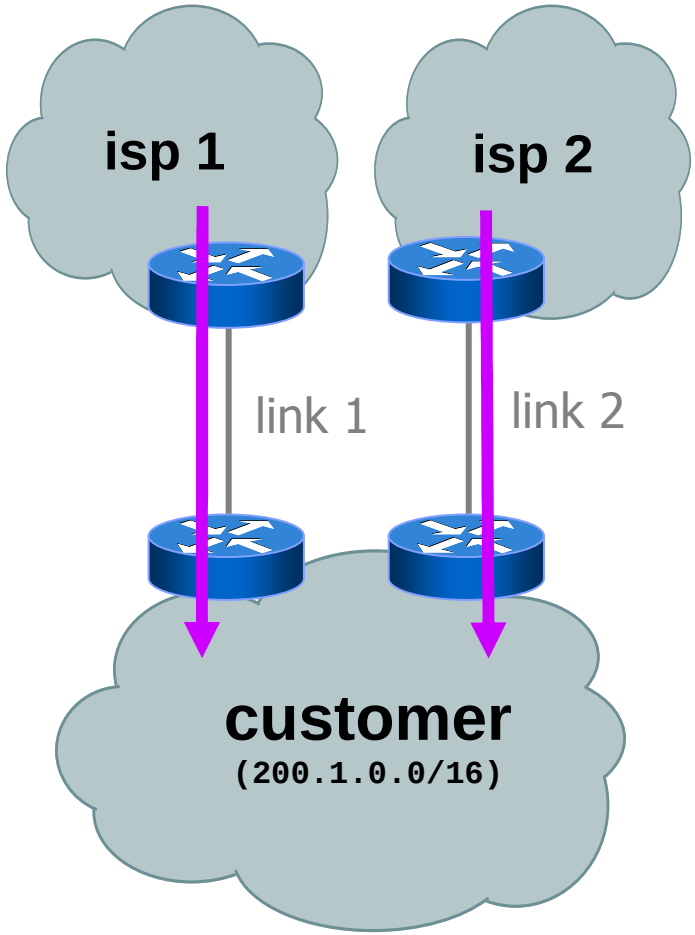


degrees of freedom



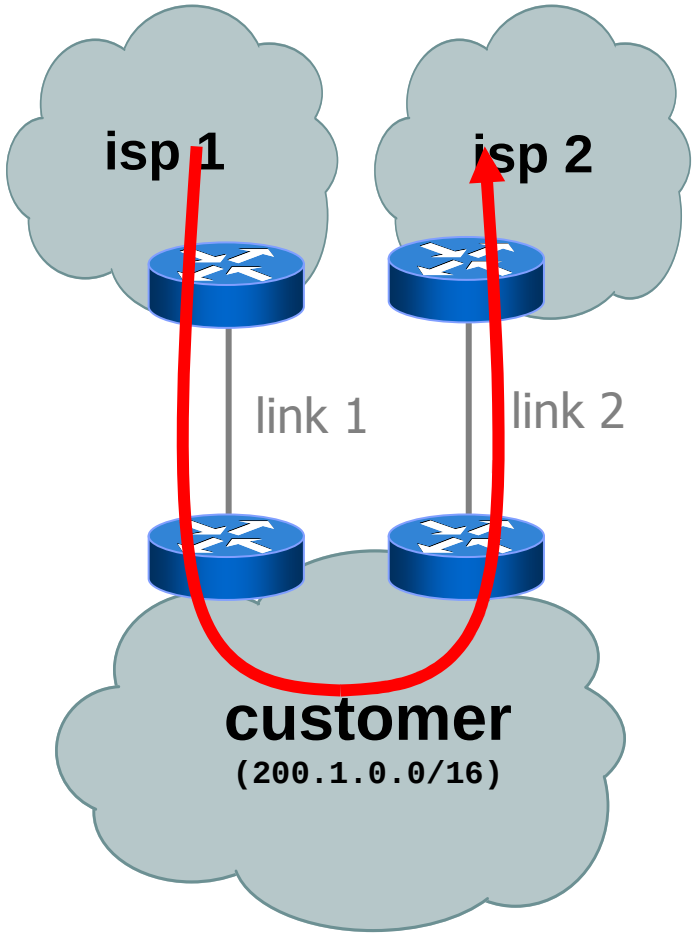
- an **outbound packet** may be sent through one of the two links in order to reach the Internet

degrees of freedom



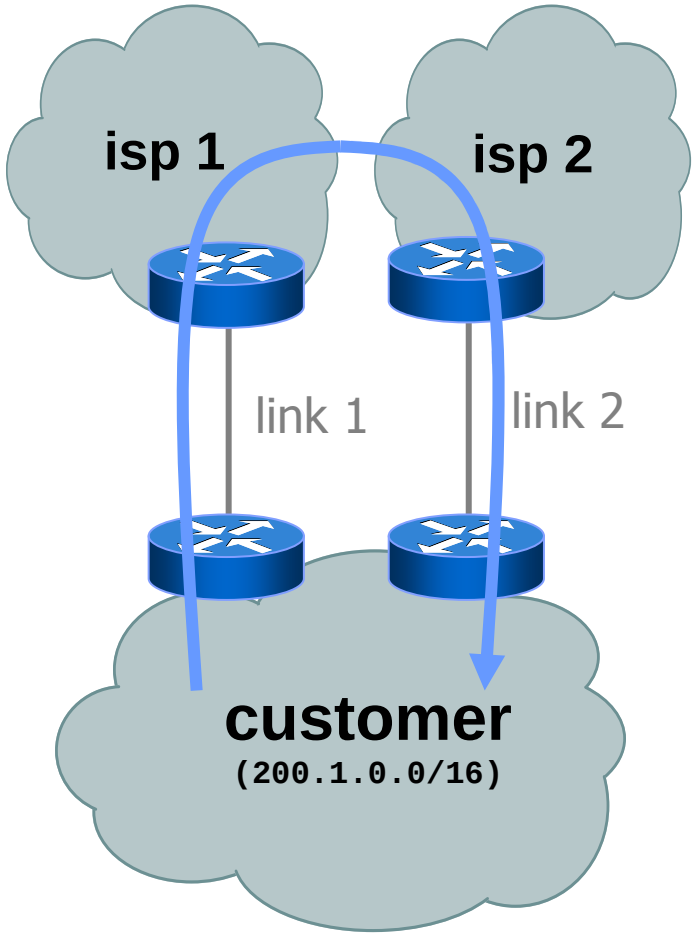
- an outbound packet may be sent through one of the two links in order to reach the Internet
- an **inbound packet** may use any of the two links in order to reach the network

degrees of freedom



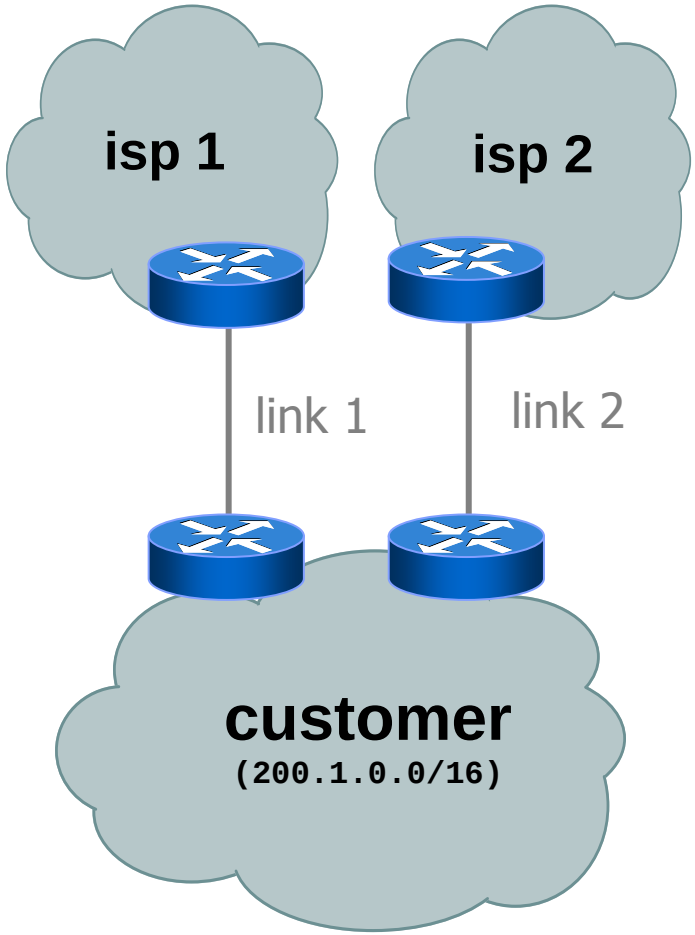
- an outbound packet may be sent through one of the two links in order to reach the Internet
- an inbound packet may use any of the two links in order to reach the network
- an **internet packet** may traverse link 1 and link 2 (or vice versa)

degrees of freedom



- an outbound packet may be sent through one of the two links in order to reach the internet
- an inbound packet may use any of the two links in order to reach the network
- an internet packet may traverse link 1 and link 2 (or vice versa)
- a **local packet** may traverse link 1 and link 2 (or vice versa)

desired policy: loadsharing

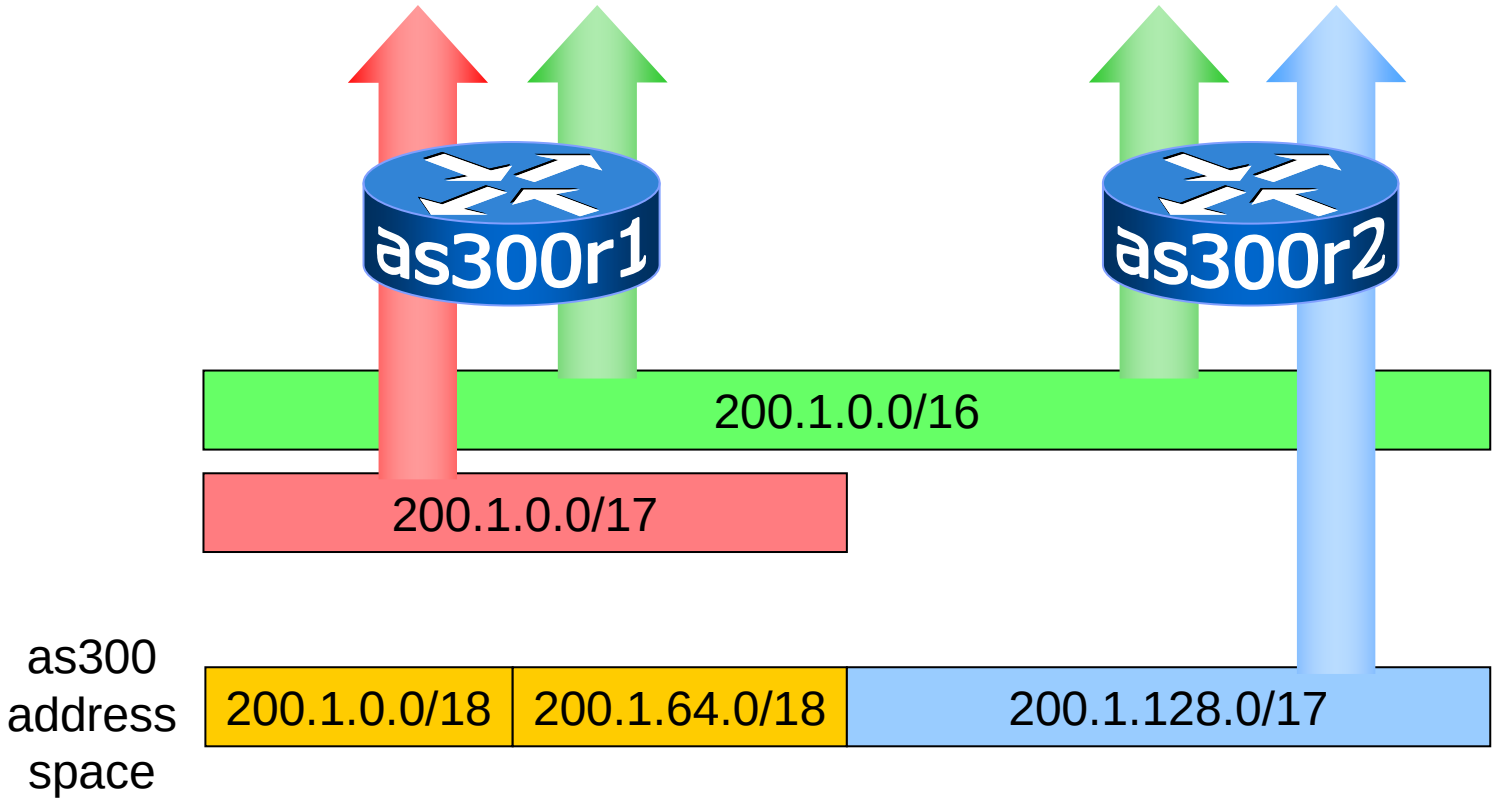


- rule out transit flows
- outbound traffic:
  - half of the internal hosts use link 1
  - the other half uses link 2
- inbound traffic:
  - use link 1 when going to half the internal hosts
  - use link 2 when going to the other half

using bgp for loadsharing

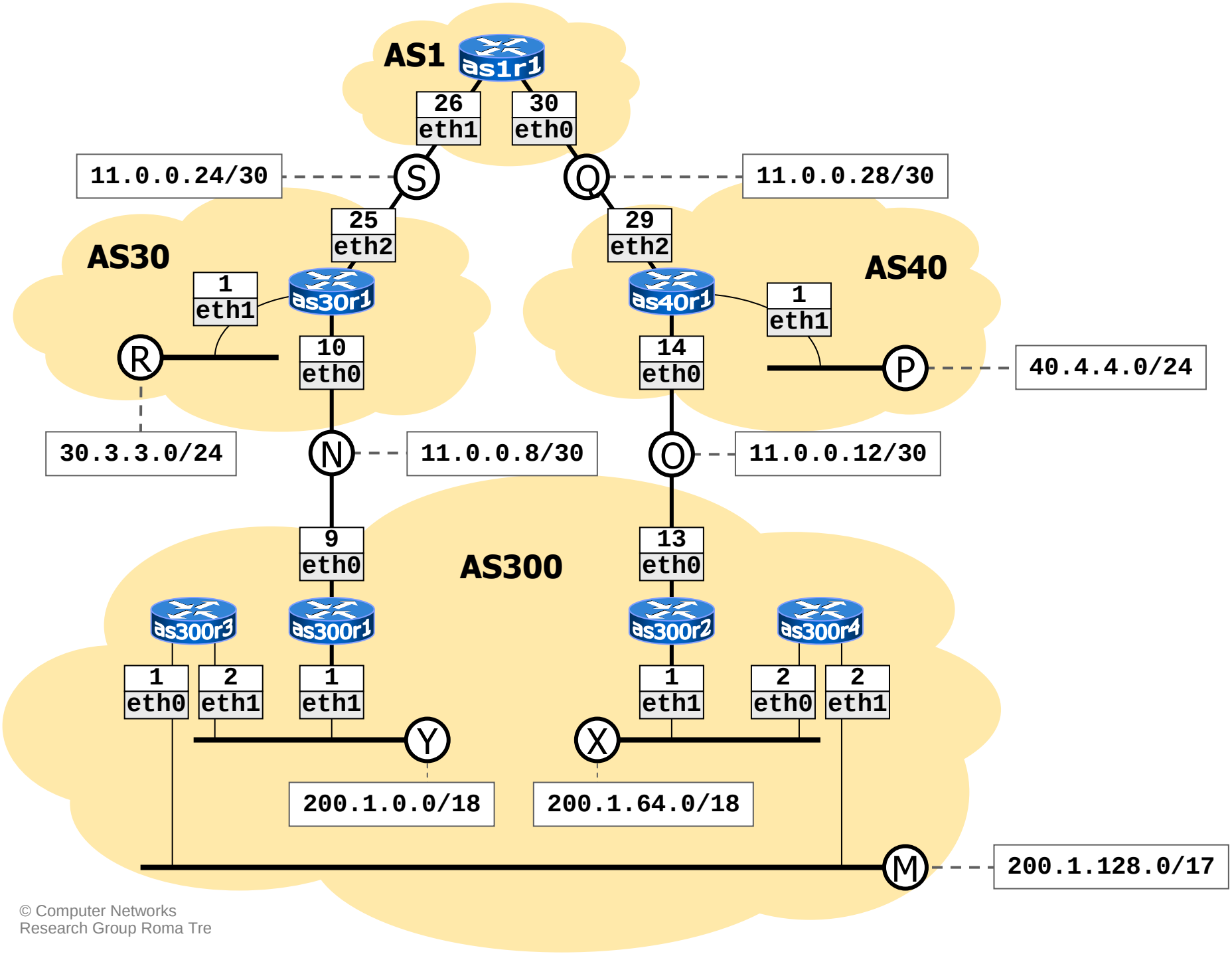
- announce `/16` aggregate on each link
- split `/16` and announce as two `/17s`, one on each link
  - rough loadsharing on inbound traffic
  - assumes equal circuit capacity and even spread of traffic across address block
- vary the split until "perfect" loadsharing achieved
- accept the default from upstream
  - basic outbound loadsharing by nearest exit ($\Rightarrow$ no local preference)
  - okay in first approximation as most customer traffic is inbound

using bgp for loadsharing



Lab Scenario Personalization

- Modify the default scenario in the following way:
  - change the network IP address to `<LAB-ID>.1.0.0/16`, where LAB-ID is your personal ID assigned by the lab instructor
- Don’t forget to change the addressing in bgpd.conf files of routers as30r1 and as40r1
- **Note well**: from now-on
  - Command-line commands should reflect this change, therefore there can be differences in the outputs shown in the manual



configure `as300r1`

zebra bgp configuration file

```
router bgp 300
network 200.1.0.0/16
network 200.1.0.0/17
!
neighbor 11.0.0.10 remote-as 30
neighbor 11.0.0.10 description Router as30r1
neighbor 11.0.0.10 prefix-list mineOutOnly out
neighbor 11.0.0.10 prefix-list defaultIn in
!
ip prefix-list mineOutOnly permit 200.1.0.0/16
ip prefix-list mineOutOnly permit 200.1.0.0/17
ip prefix-list defaultIn permit 0.0.0.0/0
```

configure as300r2

zebra bgp configuration file

```
router bgp 300
network 200.1.0.0/16
network 200.1.128.0/17
!
neighbor 11.0.0.14 remote-as 40
neighbor 11.0.0.14 description Router as40r1
neighbor 11.0.0.14 prefix-list mineOutOnly out
neighbor 11.0.0.14 prefix-list defaultIn in
!
ip prefix-list mineOutOnly permit 200.1.0.0/16
ip prefix-list mineOutOnly permit 200.1.128.0/17
ip prefix-list defaultIn permit 0.0.0.0/0
```

configure rip, test loadsharing

- **configure rip** inside `as300` **and BGP redistribution on** `as300r1` **and** `as300r2`
- experiment loadsharing

as1r1

```
as1r1:~# traceroute 200.1.0.2
traceroute to 200.1.0.2 (200.1.0.2), 64 hops max, 40 byte packets
 1  11.0.0.25 (11.0.0.25)  2 ms  2 ms  1 ms
 2  11.0.0.9 (11.0.0.9)  1 ms  2 ms  1 ms
 3  200.1.0.2 (200.1.0.2)  2 ms  3 ms  3 ms
as1r1:~# traceroute 200.1.128.2
traceroute to 200.1.128.2 (200.1.128.2), 64 hops max, 40 byte packets
 1  11.0.0.29 (11.0.0.29)  1 ms  2 ms  1 ms
 2  11.0.0.13 (11.0.0.13)  3 ms  2 ms  3 ms
 3  200.1.128.2 (200.1.128.2)  12 ms  3 ms  2 ms
as1r1:~#
```

backup

- experiment backup
  - crash collision domain **0** as follows

as300r2

```
as300r2:~# telnet localhost bgpd
......
User Access Verification

Password: zebra
bgpd> enable
Password:
bgpd# configure terminal
bgpd(config)# router bgp 300
bgpd(config-router)# neighbor 11.0.0.14 shutdown
bgpd(config-router)# quit
bgpd(config)# quit
bgpd# quit
Connection closed by foreign host.
as300r2:~# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
11.0.0.12       *               255.255.255.252 U     0      0        0 eth0
200.1.0.0       200.1.64.2      255.255.192.0   UG    3      0        0 eth1
200.1.64.0      *               255.255.192.0   U     0      0        0 eth1
200.1.128.0     200.1.64.2      255.255.128.0   UG    2      0        0 eth1
default         200.1.64.2      0.0.0.0         UG    4      0        0 eth1
```

backup

- check the routing table of **as1r1**

as1r1

```
as1r1:~# vtysh

Hello, this is Quagga (version 0.99.10).
Copyright 1996-2005 Kunihiro Ishiguro, et al.

as1r1# sh ip bgp
BGP table version is 0, local router ID is 11.0.0.26
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 30.3.3.0/24      11.0.0.25                0             0 30 i
*> 40.4.4.0/24      11.0.0.29                0             0 40 i
*> 200.1.0.0/16     11.0.0.25                              0 30 300 i
*> 200.1.0.0/17     11.0.0.25                              0 30 300 i

Total number of prefixes 4
as1r1# exit
as1r1:~# traceroute 200.1.128.2
traceroute to 200.1.128.2 (200.1.128.2), 64 hops max, 40 byte packets
 1  11.0.0.25 (11.0.0.25)  0 ms  1 ms  0 ms
 2  11.0.0.9 (11.0.0.9)  0 ms  1 ms  0 ms
 3  200.1.0.2 (200.1.0.2)  0 ms  1 ms  0 ms
 4  200.1.128.2 (200.1.128.2)  2 ms  1 ms  1 ms
as1r1:~#
```

Reporting

- Please deliver the following items to the UPEL system using your account
  1. A photocopy or a screenshot showing the output of the following commands...
     - executed on router **as1r1**:
       - **show ip bgp**
       - **traceroute <LAB-ID>.1.128.2**
       - **traceroute <LAB-ID>.1.0.2**
     - executed on router **as300r1**:
       - **show ip route**

Additional Tasks

- **Task 1**: Check if there are any packet losses after neighbor `11.0.0.14` is shutdown on **`as300r2`** using the following command on **`as1r1`**
  - `ping -R 200.1.128.2`
- **Task 2**: Change RIP configuration with OSPF configuration in AS 300
  - Note: in OSPF, additionally to BGP redistribution, you need to add `default-information originate`
- **Task3:** Repeat Task 1 and check if there are any losses. Why?