



Università degli Studi Roma Tre
Dipartimento di Informatica e Automazione
Computer Networks Research Group

netkit lab

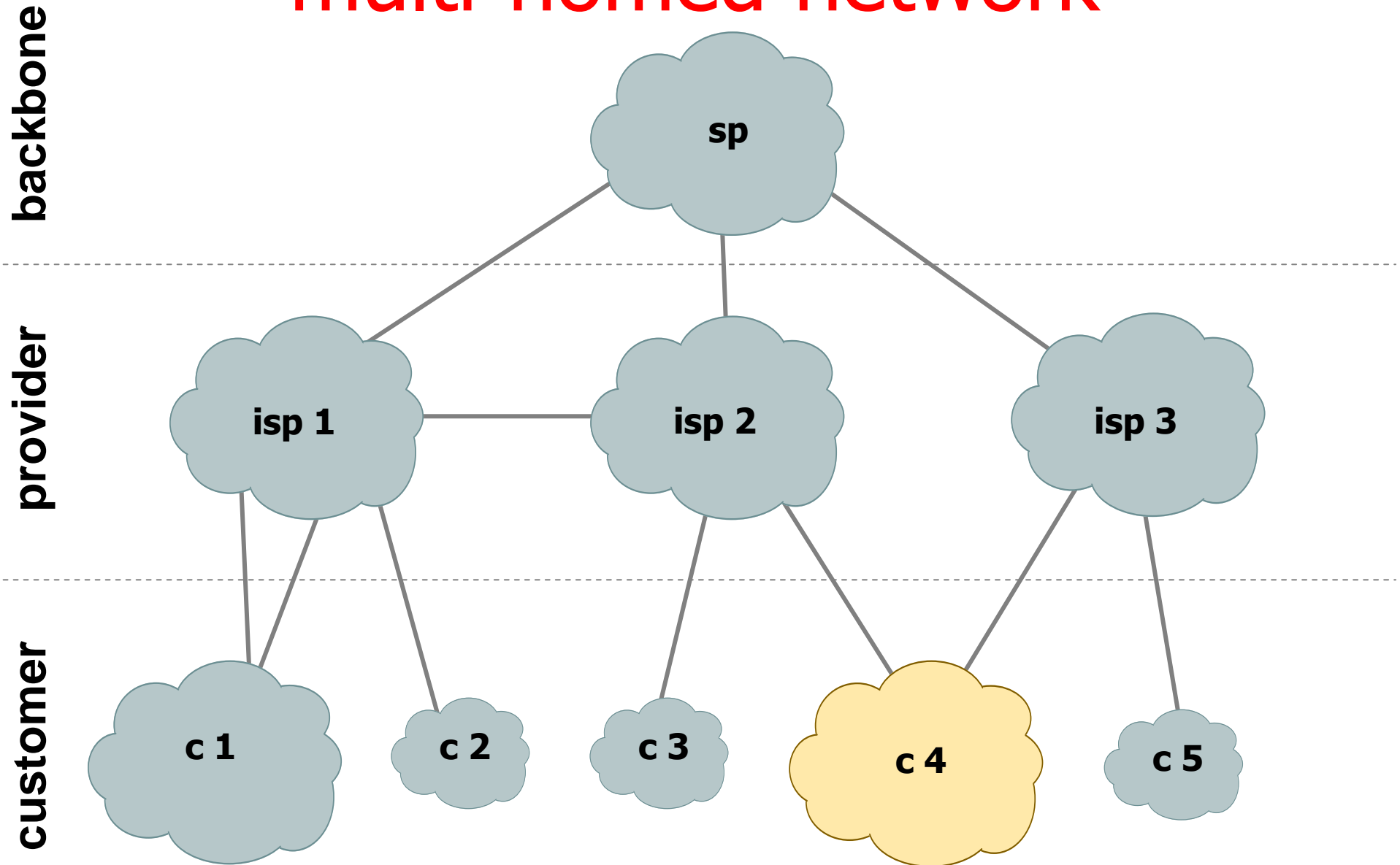
bgp: multi-homed

Version	2.0
Author(s)	G. Di Battista, M. Patrignani, M. Pizzonia, F. Ricci, M. Rimondini
E-mail	contact@netkit.org
Web	http://www.netkit.org/
Description	configuration of a multi-homed network with backup and load sharing

copyright notice

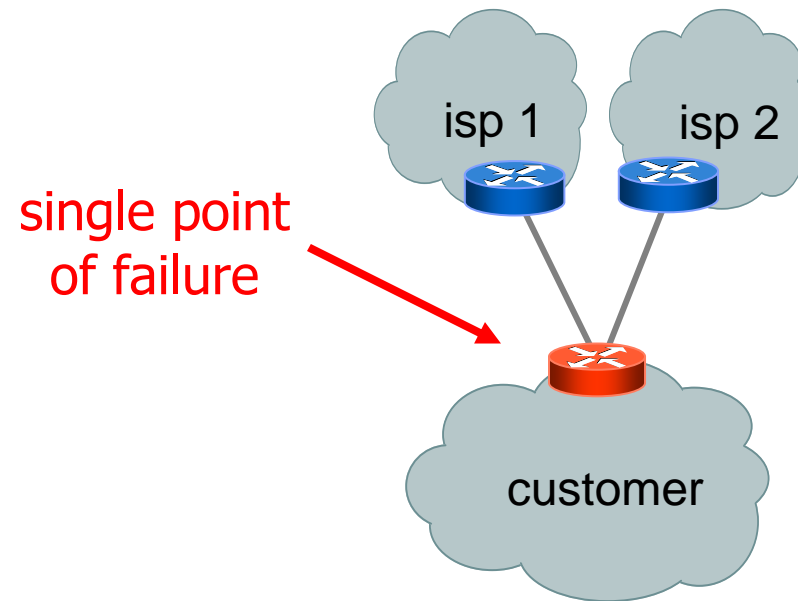
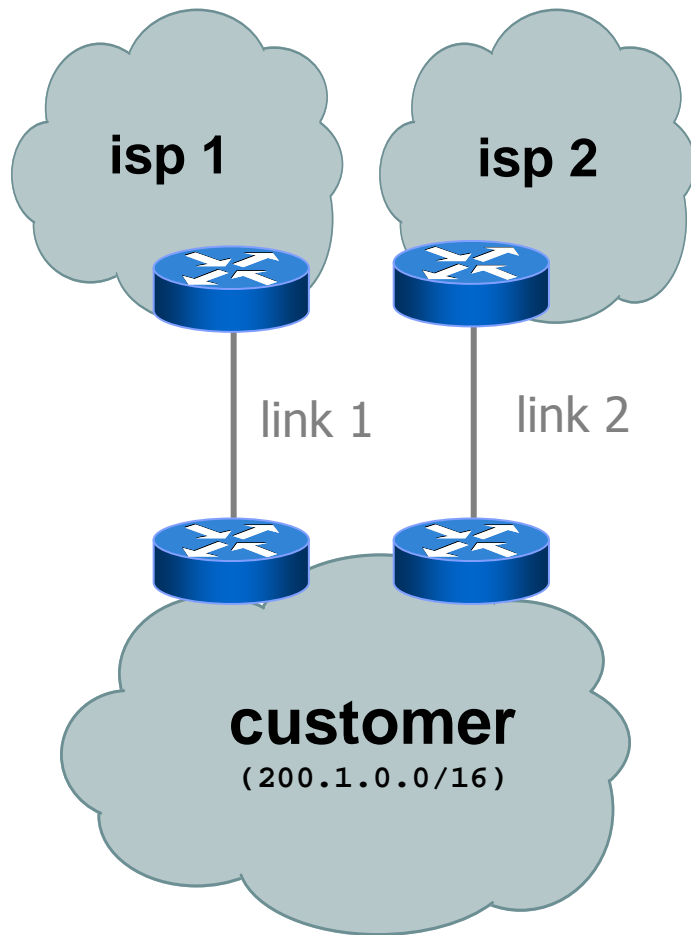
- All the pages/slides in this presentation, including but not limited to, images, photos, animations, videos, sounds, music, and text (hereby referred to as "material") are protected by copyright.
- This material, with the exception of some multimedia elements licensed by other organizations, is property of the authors and/or organizations appearing in the first slide.
- This material, or its parts, can be reproduced and used for didactical purposes within universities and schools, provided that this happens for non-profit purposes.
- Information contained in this material cannot be used within network design projects or other products of any kind.
- Any other use is prohibited, unless explicitly authorized by the authors on the basis of an explicit agreement.
- The authors assume no responsibility about this material and provide this material "as is", with no implicit or explicit warranty about the correctness and completeness of its contents, which may be subject to changes.
- This copyright notice must always be redistributed together with the material, or its portions.

multi-homed network



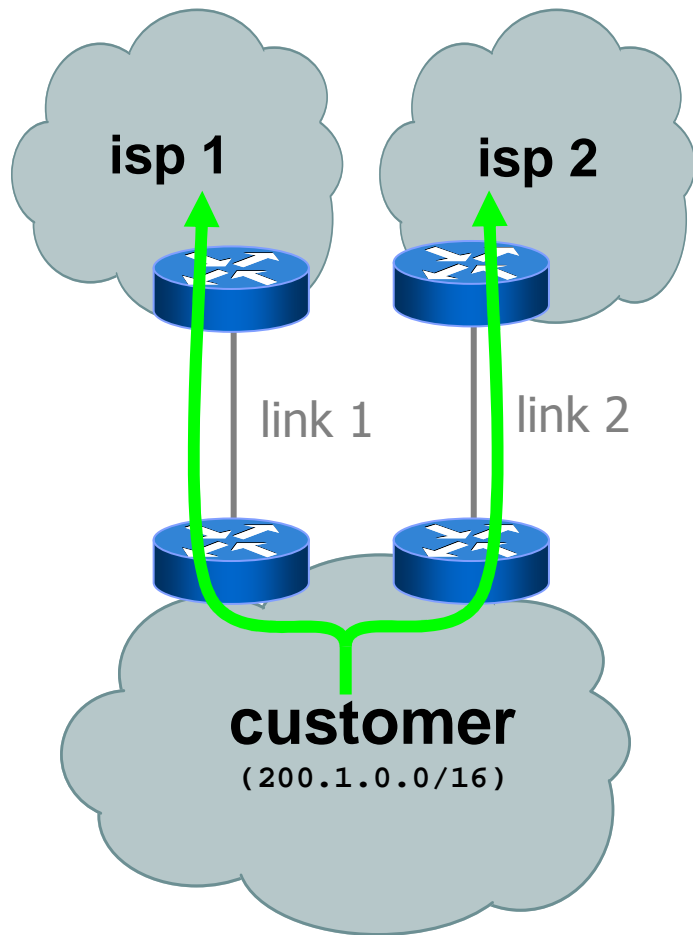
multi-homed network

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

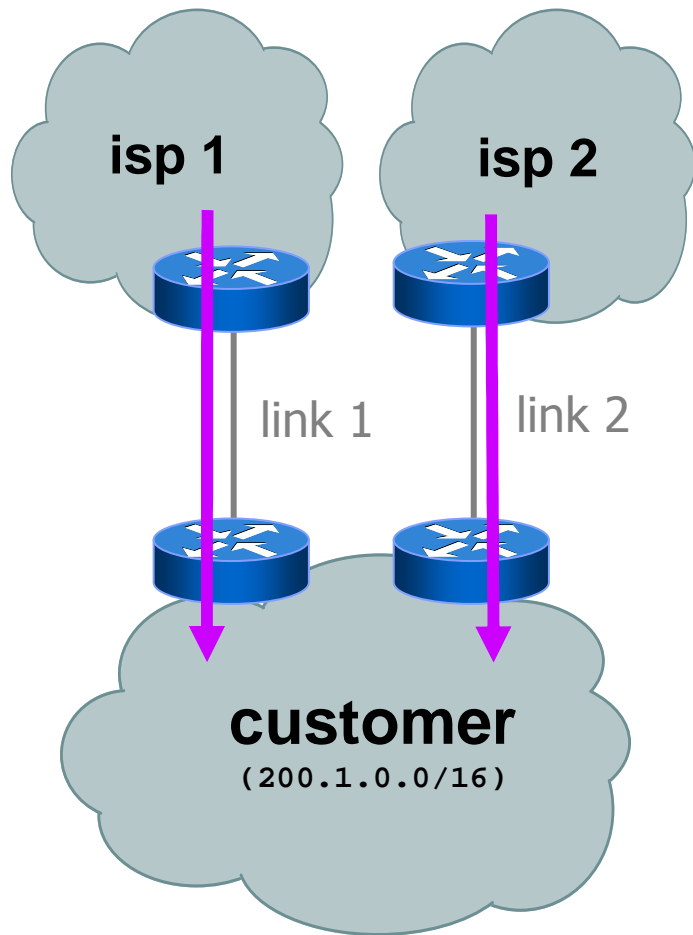


degrees of freedom

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

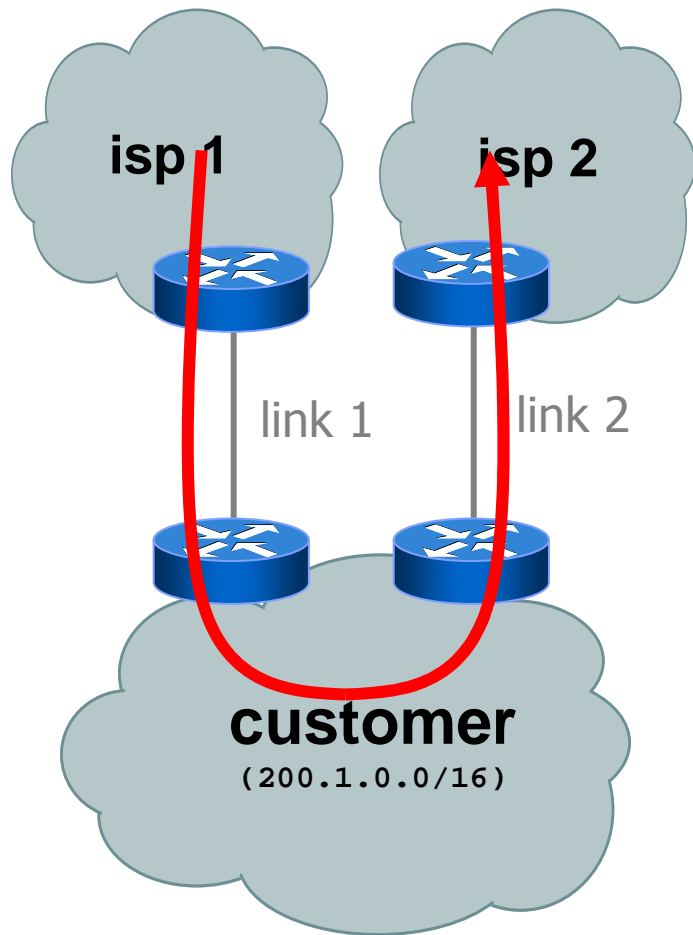


degrees of freedom



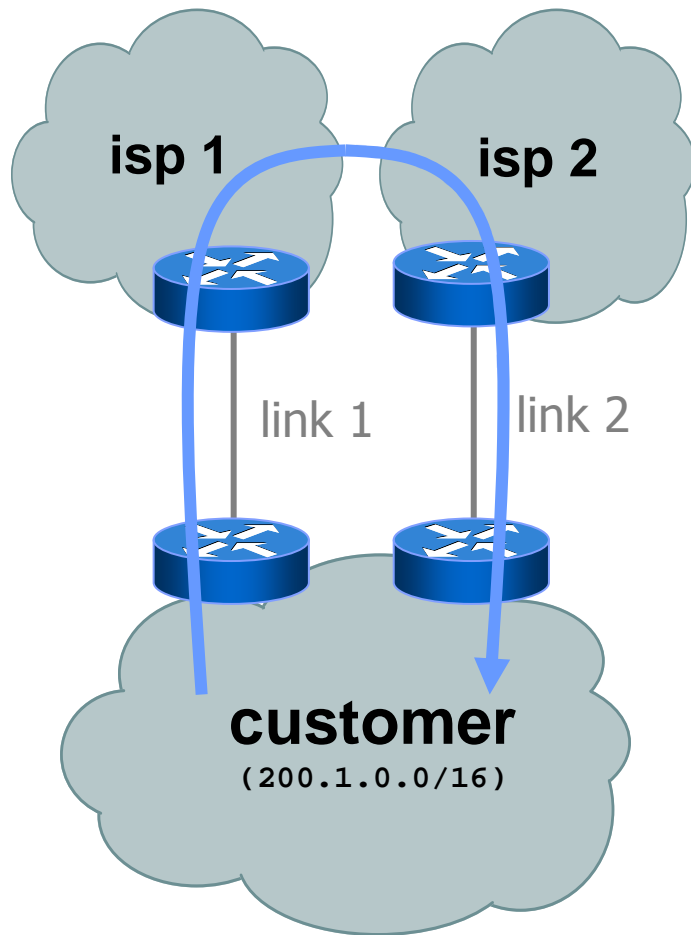
- an outbound packet may be sent through one of the two links in order to reach the internet
- an inbound packet may use any of the two links in order to reach the network

degrees of freedom



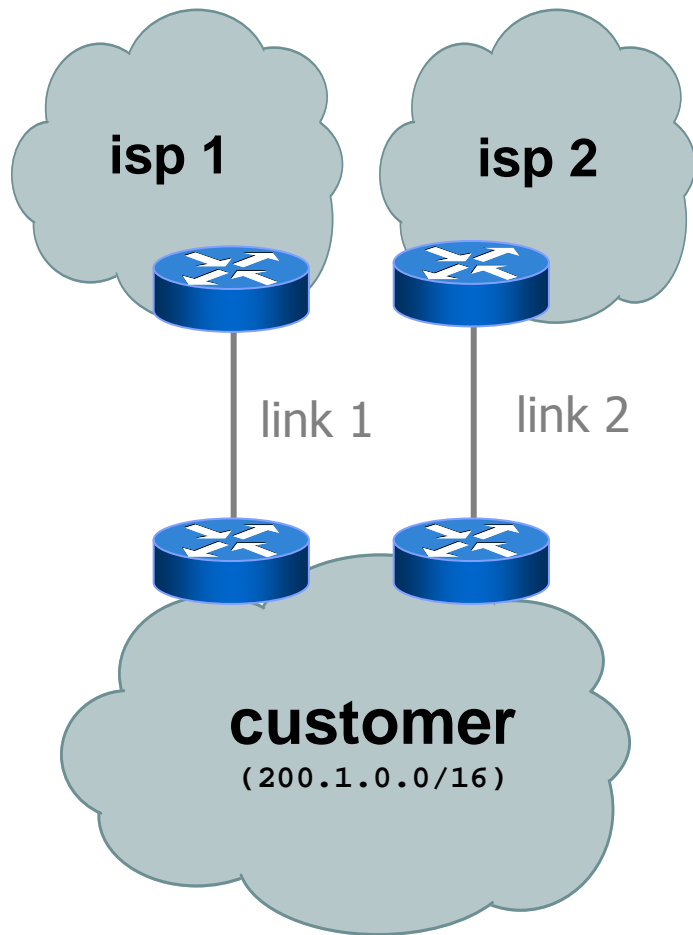
- an outbound packet may be sent through one of the two links in order to reach the internet
- an inbound packet may use any of the two links in order to reach the network
- an internet packet may traverse link 1 and link 2 (or vice versa)

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

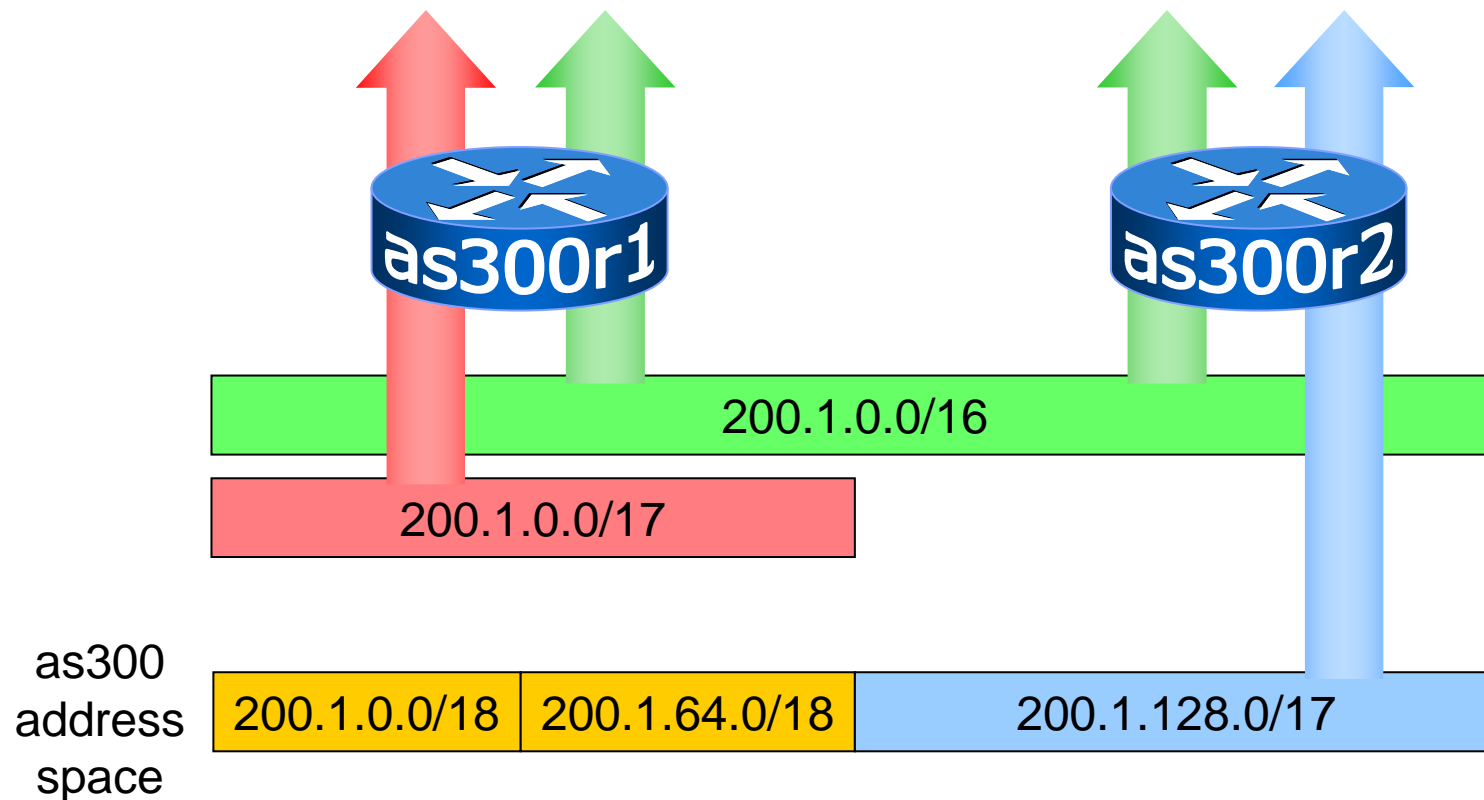


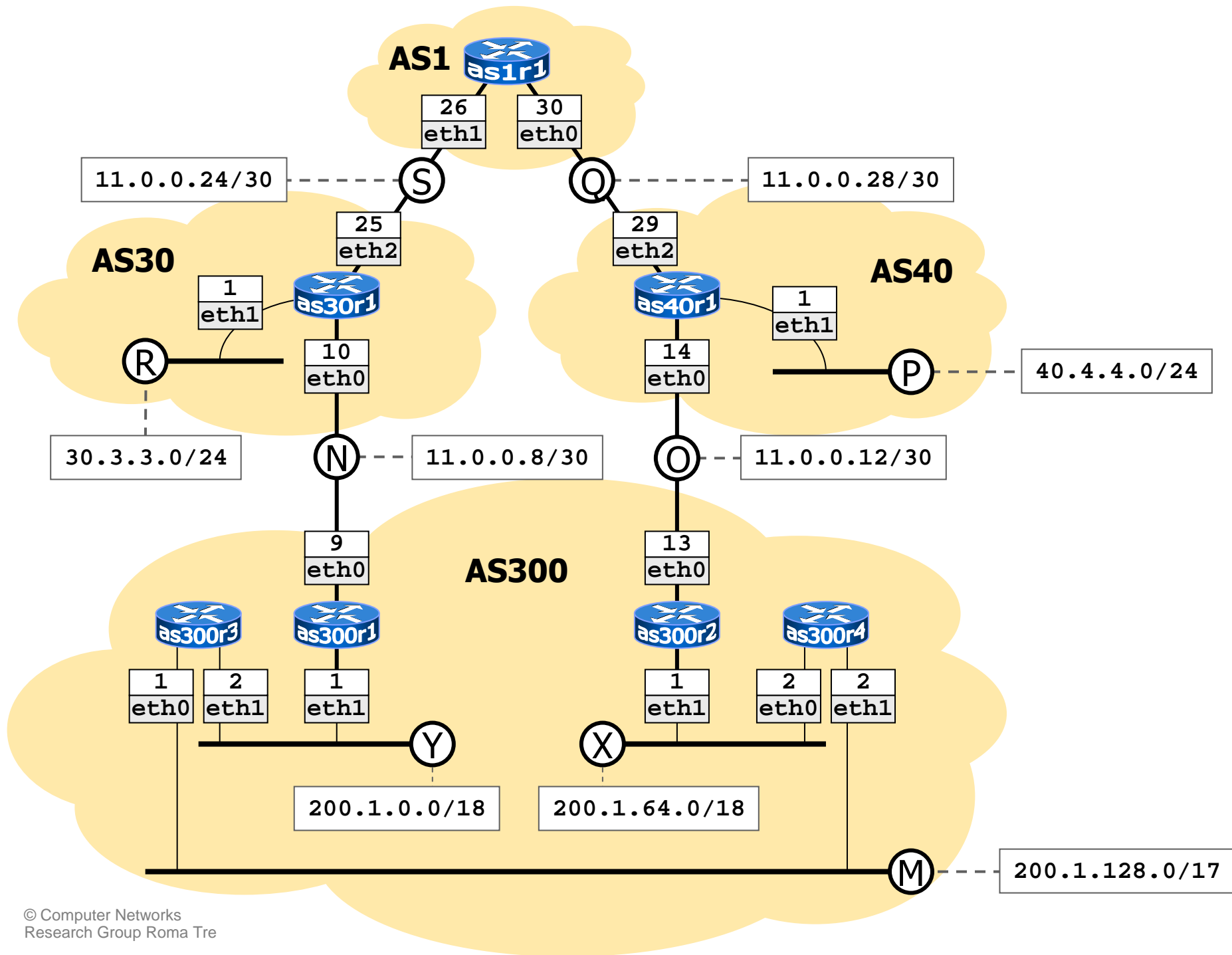
- rule out transit flows
- outbound traffic:
 - half of the internal hosts use link 1
 - the other half uses link 2
- inbound traffic:
 - use link 1 when going to half the internal hosts
 - use link 2 when going to the other half

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 (⇒ no local preference)
 - okay in first approximation as most customer traffic is inbound

using bgp for loadsharing





router as300r1 configuration



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
```

router as300r2 configuration



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
```

loadsharing

- 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:~# █
```

- check the rip routing inside as300

backup

- experiment backup
 - crash collision domain 0 as follows:

```
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

```
bgpd> show ip bgp
BGP table version is 0, local router ID is 11.0.0.30
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 0.0.0.0	0.0.0.0	0		32768	i
*> 11.0.0.8/30	11.0.0.25	0		0	30 i
*> 11.0.0.12/30	11.0.0.29	0		0	40 i
*> 11.0.0.24/30	0.0.0.0	0		32768	i
*> 11.0.0.28/30	0.0.0.0	0		32768	i
*> 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 9

```
bgpd> quit
```

Connection closed by foreign host.

```
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) 3 ms 2 ms 1 ms
 2 11.0.0.9 (11.0.0.9) 3 ms 2 ms 1 ms
 3 200.1.0.2 (200.1.0.2) 13 ms 3 ms 2 ms
 4 200.1.128.2 (200.1.128.2) 14 ms 3 ms 4 ms
```