netkit lab

bgp: multi-homed

<table>
<thead>
<tr>
<th>Version</th>
<th>2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>G. Di Battista, M. Patrignani, M. Pizzonia, F. Ricci, M. Rimondini</td>
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<tr>
<td>Web</td>
<td><a href="http://www.netkit.org/">http://www.netkit.org/</a></td>
</tr>
<tr>
<td>Description</td>
<td>configuration of a multi-homed network with backup and load sharing</td>
</tr>
</tbody>
</table>
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multi-homed network

isp 1  isp 2  isp 3

sp

c 1  c 2  c 3  c 4  c 5

customer

provider

backbone

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netkit – [ lab: bgp-multi-homed ]

last update: May 2007
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

![Diagram showing ISP connections to a customer network with two ISPs and a choice of links to reach the internet.](image-url)
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).

![Diagram showing ISP links and degrees of freedom](image-url)
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

200.1.0.0/16
200.1.0.0/17
200.1.0.0/18
200.1.64.0/18
200.1.128.0/17

as300

address
space

netkit – [ lab: bgp-multi-homed ]

last update: May 2007
router as300r1 configuration

```
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
```

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netkit – [ lab: bgp-multi-homed ]

last update: May 2007
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

```
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
```

```
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
```

- check the rip routing inside as300
backup

- experiment backup
- crash collision domain O 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     0     eth0
200.1.0.0     200.1.64.2      255.255.192.0   UG    3      0    0     0     eth1
200.1.64.0    *                255.255.192.0   U     0      0    0     0     eth1
200.1.128.0   200.1.64.2      255.255.128.0   UG    2      0    0     0     eth1
default       200.1.64.2      0.0.0.0          UG    4      0    0     0     eth1
```
backup

- check the routing table of 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

<table>
<thead>
<tr>
<th>Network</th>
<th>Next Hop</th>
<th>Metric</th>
<th>LocPrf</th>
<th>Weight</th>
<th>Path</th>
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<tbody>
<tr>
<td>0.0.0.0</td>
<td>0.0.0.0</td>
<td>0</td>
<td>32768</td>
<td>i</td>
<td></td>
</tr>
<tr>
<td>11.0.0.8/30</td>
<td>11.0.0.25</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>i</td>
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<tr>
<td>11.0.0.12/30</td>
<td>11.0.0.29</td>
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<td>0</td>
<td>40</td>
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<tr>
<td>11.0.0.24/30</td>
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<td>0</td>
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<td>11.0.0.28/30</td>
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<td>0</td>
<td>32768</td>
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<td>30.3.3.0/24</td>
<td>11.0.0.25</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>i</td>
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<td>0</td>
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<td>i</td>
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<td>200.1.0.0/16</td>
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<td>0</td>
<td>0</td>
<td>30 300</td>
<td>i</td>
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Total number of prefixes 9
bgpd> quit
Connection closed by foreign host.
```