Multi-Homing

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What is site multi-homing?

A site is multi-homed when it connects to more than one IP service provider.
Motivations for multi-homing from multi6

- Redundancy
  - Physical/logical link failure
  - Routing failure
  - Provider failure
- Load sharing/load balance
- Performance issues such as long term congestion
- Policy
IPv4 multi-homing solutions

Site S1
163.117.23.0/24

Site S2
163.117.12.0/24

ISPA
163.117.0.0/16

Internet

BGP routing information
IPv4 multi-homing solutions

BGP routing information
IPv4 multi-homing solutions

ISPA

Internet

Site S1

163.117.23.0/24

Site S2

163.117.12.0/24

163.117.0.0/16

BGP routing information
IPv4 multi-homing solutions

Internet

ISP A

ISP B

Site S2

Site S1

163.117.0.0/16

163.117.0.0/16

163.117.12.0/24

163.117.12.0/24

163.117.23.0/24

163.117.23.0/24

163.117.23.0/24

BGP routing information
IPv4 multi-homing solutions

Internet

ISPA

Site S2

163.117.0.0/16

163.117.0.0/16

163.117.12.0/24

163.117.12.0/24

ISPB

Site S1

163.117.12.0/24

163.117.23.0/24

163.117.23.0/24

163.117.23.0/24

BGP routing information
IPv4 multi-homing solutions

163.117.0.0/16

163.117.12.0/24

Site S2

163.117.12.0/24

163.117.23.0/24

Site S1

163.117.23.0/24

ISPA

Internet

163.117.0.0/16

163.117.23.0/24

Plus its own routes

ISPB

163.117.23.0/24

→ BGP routing information
Benefits of actual IPv4 multi-homing

- Simplicity: little more than BGP peer. (depends on the desired features)
- Optimal fault-tolerance: connectivity preserved if there is at least one valid path (including established TCP connections)
- Traffic-engineering based on advertised routes and BGP attributes
Limitations of IPv4 multi-homing

- Routing system scalability: major contributor to BGP routing table size explosion
- Routing table size is precluding fault-tolerance features since route withdrawal can take several minutes
- “Tragedy of the commons”
Others IPv4 multi-homing solutions

- RFC 2260
  - Limited route injection: route information is only injected in case of failure
  - Tunnels
Multi-homing: IPv6 constraints

- Provider based aggregation

```
TLA1::
  /   \
TLA1:NLA1:: TLA1:NLA2::
  / \
TLA:NLA1:NLAA:: TLA1:NLA2:NLAb::
     /\
TLA1:NLA2:NLAc::
```
Multi-homing: IPv6 constraints

- Provider based aggregation

  TLA1::
  TLA1:NLA1::
  TLA:NLA1:NLAa::
  TLA1:NLA2::
  TLA1:NLA2:NLAb::
  TLA1:NLA2:NLAc::

- Preservation of routing system scalability
  - Prevents route injection over the DFZ
  - Precludes currently deployed IPv4 solutions
IPv6 multi-homing scenario
IPv6 site-multihoming requirements
by multi6 (Work in progress)

- IPv4 multi-homing capabilities MUST be supported
  i.e. Redundancy, Load-sharing, Performance, Policy,
  Simplicity, Transport-layer Survivability
- Scalability: must accommodate orders of magnitude
  more multi-homed sites
- Minor/parallel stack changes on hosts and routers
- No cooperation between different ISPs
Available IPv6 multi-homing solution

- Tunnels: Based on RFC 2260
- Major limitation:
  - Limited fault tolerance.
- Does not provide tools to achieve other goals such as load-sharing, policying, performance.
Current status

• Several personal submitted solutions will be discussed
References