Six/One Router
A Scalable and Backwards-Compatible Solution for Provider-Independent Addressing

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MobiArch workshop, Seattle, August 22, 2008
Towards More Scalable and Flexible Routing

- **core**: flexible, but not scalable
  - global routing table at every provider
  - track route changes Internet-wide

- **edge**: scalable, but inflexible
  - provider-allocated addresses
  - renumbering on provider change
  - multi-homing infeasible

- Need routing architecture that...
  - is scalable
  - avoids renumbering
  - supports multi-homing
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IP address: 2000:deff:2:1234:3ae:1b8:f5ff:fed
prefix = provider
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Address Indirection

- decouples addressing at edge from Internet core
- global mapping system for remote edge addresses
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provider-allocated transit addresses in core

provider-independent edge addresses

forward mapping

indirection router

reverse mapping
Address Indirection

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- global mapping system for remote edge addresses
Address Indirection with Tunneling

- increased bandwidth consumption
- prolonged path
- no incentives model for proxies
Contribution of Six/One Router

- address indirection enabling…
  - minimum extra packet overhead
  - direct-path routing
  - autonomous deployment

idea: one-to-one address rewriting
Network Setup and Addressing

- one-to-one mapping between edge/transit addresses

Provider-independent edge addresses: ABC::/48

Provider-allocated transit addresses: 1000::/48

- host has edge address ABC::1
- Six/One router rewrites
- assigns
- edge network
- provider

Assigns
Owns
Address Rewriting

- provider-independence by rewriting local addresses
- transparency through rewriting remote addresses
Backwards Compatibility

- natural fall-back to unilateral rewriting
- loss of transparency requires NAT traversal support
Multi-Homing Support

A host has edge addresses ABC::1 and BCD::1.

The host connects to two provider networks, each with an edge address:
- ABC::/48
- BCD::/48

Each provider network has an edge network with an address:
- 1000::/48
- 2000::/48

The correspondent host is connected to another edge network with an address.
- edge network has edge address FED::2
Multi-Homing Support

- Redirect via packet extension with original edge address

Diagram:
- ABC::/48
- 1000:/48
- BCD::/48
- 2000::/48
- Correspondent host
- Edge network
- Host
- Provider
- Has edge address FED::2

- From BCD::1 to FED::2
- From BCD::1 to 9000::2
- From FED::2 to BCD::1
- From 1000::1 extension (BCD::1) to 9000::2
- From 9000::2 to 1000::1 extension (BCD::1)
- From FED::2 to BCD::1
Conclusions

address indirection enabling…
- minimum extra packet overhead
- direct-path routing
- autonomous deployment’

…possible with one-to-one address rewriting
- transparent with bilateral rewriting
- backwards compatible with unilateral rewriting

future work: implementation and experimentation