

IPv6 Addressing Considerations

(draft-gont-v6ops-ipv6-addressing-considerations)

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Goals of this document

- Perform an architectural analysis of IPv6 addresses
 - What kind of properties do they have?
 - What are their implications?
- Analyze the extent to which IPv6 addressing is currently leveraged
 - And what the consequences are
- Gap analysis
 - What are we currently missing to fully leverage IPv6 addressing?

Address Properties

- Scope
 - Network-span where an address uniquely identifies a network interface
 - Typically has implications on reachability (i.e., reachability \leq scope)
 - Implications: host exposure, address stability
- Reachability
 - Whether packets sent to an a destination address will reach the target
 - Affected by scope & filtering policies
 - Implications: host exposure

Address Properties (II)

- Provider dependency
 - Whether an address is tied to the upstream provider
 - Implications: address stability, multihoming
- Stability
 - The extent to which addresses change over time
 - Affected by prefix stability (provider dependency)
 - Affected by address type (stable addresses vs. temporary addresses)
 - Implications: host exposure, privacy, operational considerations

How are IPv6 addresses currently employed?

- Configuration
 - “One size fits all” → e.g. stable + temporary addresses in all scenarios
- Usage
 - “One size fits all”
 - Clients: Typically use IPv6 default address selection (RFC6724)
 - Servers: Accept incoming connections on all configured addresses

Implications

- Address configuration
 - One size seldomly fits all
 - Host expectations != network expectations
 - SLAAC/DHCPv6 interaction
- Address usage
 - may use temporary addresses for long-lived sessions
 - may use global addresses for services only meant for the local link
 - may accept incoming connections on temporary addresses

Gaps

- Better APIs
 - Ability to select addresses based on properties
 - stability: stable vs. temporary vs. ephemeral addresses
 - scope/reachability
- Advice on IPv6 address usage
 - Such that applications can better leverage IPv6 addressing
 - Handle ephemeral addressing gracefully

Gaps (II)

- Profile-based address configuration
 - e.g. stable-only vs. stable + temporary vs. temporary-only
- Protocol improvements to deal with many addresses
 - Allow the network to convey information about number of addresses
 - Allow hosts to register/de-register addresses
 - Support for Prefix Delegation
 - Increased support of DHCPv6-PD
 - Alternatives (SLAAC PD?)

Gaps (III)

- Firewall traversal for CE Routers
 - Many CE Routers “only allow outgoing communications”
 - ... but no support for e.g. IPv6-based UPnP or PCP
 - Worse e2e reachability than in the IPv4 case! :-)
- Support for multi-prefix/multi-router networks
 - Extremely likely to be broken without RFC 8028
 - RFC 8028 → MUST
 - More work may be needed

Moving forward

- Comments?
- Next steps?