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 an all configured addresses
Implications

- Address configuration
  - One size seldomly fits all
  - Host expectations $\neq$ 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?