An Extension of Format for IPv6 Scoped Addresses

<draft-ietf-ipngwg-scopedaddr-format-00.txt>

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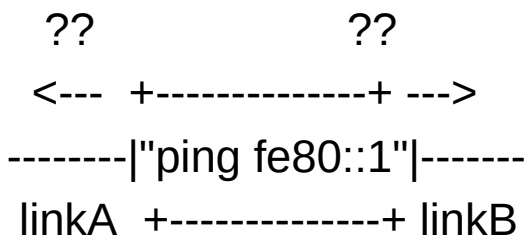
Terminologies

- Scope
  - node-local, link-local, site-local, organization-local, global...
- Scope identifier
  - a particular instance of a scope
  - "link identifier" will also be used as an identifier of a link-local scope
  - zone ID, perimeter ID, region ID,... are not used in this presentation

Problems

- An IPv6 scoped address does not provide sufficient information on a scope boundary.
  - "ping fe80::1" would confuse the ping program if you have 2 links



    - an identifier of the link should be provided to the program
    - same kind of problems arise in site-local addresses
  - It’s hard to reuse scoped addresses using "cut and pase".
    - e.g: lookup a routing table and telnet to a gateway
    - a link-local gateway can’t be "cut and pasted" without a link ID

Approaches so far

- Specify a scope ID as a command line option or something
  - e.g. "ping -S 1 fe80::1"
    - need extra code for each application
    - does not help "cut and paste"
    - you can’t always use the same option for this purpose
- Introduce a "default" scope ID for each system
  - Not a complete solution
    - you should still specify the ID when using a scope other than the default

Proposed Solution

- Introduce a new format for scoped addresses:
  - <scoped_address><delimiter><scope_id>
  - Example: fe80::1-2
    - scoped_address = "fe80::1"
    - delimiter = ’-’
    - scope_id = "2"
  - Should be applied to both unicast and multicast

- Extend library functions that translate between a hostname and a numeric address
  - takes a literal address in the extended format
  - returns a numeric address structure that contains the scope ID
  - Note: we don’t recommend you to use any particular library functions

The Benefits

- An application can just use the extended library functions
  - it is not necessary to extend present applications.
- A user can easily "cut and paste" scoped addresses
  - the address format itself has enough information of scope

Implementation(1) Address extension

- KAME's extended format for scoped addresses
  - (currently) for link-local addresses only
  - interface name as link ID
    - assuming 1to1 mapping between links and I/Fs
  - '@' as the delimiter
  - e.g. fe80::1@ne0 = fe80::1 on the link specified by ne0

Implementation(2) API extension

- Use sin6_scope_id to specify a scope (i.e. link) ID
  - kernel sends a packet to the link specified by sin6_scope_id
  - kernel sets a link ID of a received packet to sin6_scope_id
- KAME's getaddrinfo supports the extended format
  - takes an address as a hostname in the extended format
  - sets the according scope ID to the sin6_scope_id field
- getnameinfo is also extended
  - takes sockaddr_in6{}
  - returns a literal address in the extended format.

Implementation: How it works

```
          getaddrinfo
         ---------------> {sin6_family = AF_INET6, ...,
fe80::1@ne0                  sin6_addr = "fe80::1",
         <---------------  sin6_scope_id = linkID(ne0)}
          getnameinfo
```

Examples

- ping command
  - needs no option to handle link-local addresses

```
% ping6 fe80::290:27ff:fe3c:1817@ef0
PING6(56=40+8+8 bytes) fe80::2a0:24ff:fe66:1350 --> fe80::290:27ff:fe3c:1817
16 bytes from fe80::290:27ff:fe3c:1817@ef0, icmp_seq=0 hlim=64 time=0.784 ms
```

- output of netstat -rn command

```
Internet6:
Destination                 Gateway                 Flags  Intface
default                     fe80::5254:ff:fedc:5217@ef0   UG      ef0
```

- telnet command

```
 % telnet fe80::5254:ff:fedc:5217@ef0
Trying fe80::5254:ff:fedc:5217...
Connected to fe80::5254:ff:fedc:5217@ef0.
Escape character is '^]'.
 ...
```

Related (Open) Issues (1)

- We'd better to define specific syntax for portability.

- What is the desired delimiter?
  - KAME's '@' seems not good
  - other candidates
    - <scope_id>/<address> (used in MSR)
    - <address>-<scope_id>
  - are alphabetical characters better?
    - [S|s]<scope_id>:<scoped_address>
    - is "S12A:FEC0::123:4567:89AB:CDEF" easy to read?

- What is the desired order of <address>, <delimiter>, and <id>?
  - is <scope_id> the most significant part?
  - if so, should it be placed before <address>?

Related (Open) Issues (2)

- What is the desired identifier?
  - interface name
    - not so intuitive
    - (sometimes) even confusing; how to distingush I/F, link, site, ...
  - numerical identifiers
    - tend to change, not intuitive
  - should an identifier be unique in a scope?
    - e.g. a company name for a site
    - name distribution (or discovery) problem
    - how to avoid confliction

- Scoped Addresses in URL's
  - http://[fec0::1234-bar.com]:80/index.html would be better than
  - http://[fec0::1234]:80/index.html

Related (Open) Issues (3)

- **Many API issues**
  - extension for getipnodebyname(), getipnodebyaddr()
  - need another structure?
  - semantics of sin6_scope_id
  - should be separately discussed