MANET Autoconfiguration

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Goals

• Automatically configure addresses, prefixes and other information
• Avoid multilink subnet issues
• Avoid address duplication
• Discover and select exit routers
• Support mobile networks
• Use existing mechanisms
Types of addresses/prefixes

- **Link-local (LL)** - non-routable; local link only
- **MANET-local (MLA)** - routable within a MANET
- **Unique-local (ULA)** - routable within a MANET and also between interconnected MANETs
- **Centrally-assigned Unique-local (ULA-C)** - same as ULA, but also registered with a central authority
- **Global (derived from home network)** - globally routable and taken from home network prefix space; used for *home address; mobile network prefix*
- **Global (delegated from MNBR)** - globally routable and delegated by MNBR; used for *care-of address, visited network prefix*
Challenges

• MANETs are *multi-link sites* - they are formed over asymmetric reachability links
  – see RFC4903 (Multi-link Subnet Issues) and draft-ietf-autoconf-manetarch-04.txt (MANET Architecture)

• MANETs are *multi-hop* - there may be multiple IP forwarding hops between nodes within the same MANET
  – link-scoped functions do not work as expected (RA/RS, DAD, NUD, LLMNR, mDNS, etc.)

• MANET interfaces are inherently neither *ingress* nor *egress* - they are *neutral*
Two basic solutions

- Raw use of the MANET multilink site with changes to neighbor discovery model (discussed in draft)
- Virtualize the MANET to appear as a shared link via IP-in-IP encapsulation
  - *We call this “Virtual Ethernet (VET)”*
  - *THE IDEA AND NAME ARE NOT NEW!*
Virtual Ethernet (VET)

- Each MANET Router (MNR) configures a VET interface over its (underlying) MANET interfaces.
- Each VET interface connects to an imaginary shared link (i.e., a “Virtual Ethernet”).
- Each VET interface configures a LL address.
- Then:
  - All MNRs are single-hop neighbors on the VET.
  - IPv6 Autoconfiguration is done over the VET.
  - Link-scoped services work as-normal over the VET.
MANET with Virtual Ethernet (VET)
MANET Router (MNR)

Egress Interfaces (to Internet)

^ ^ ^
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| Internal hosts | | | .... | | A
| an routers | | | N
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| | (H1)----+ | | I /*+--------< T
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| Ingress Interfaces | | .... | | s
| (to internal networks) | | | | s

^ ^ ^
| | | v v v
| Ingress Interfaces (to mobile networks)

^ ^ ^
MNR Autoconfiguration Procedure

- configure MANET Local Addresses (MLAs) on MANET interfaces (DHCP, ULA, manual config, etc.)
- engage in MANET routing protocol (if necessary)
- configure VET interface(s) over underlying MANET interfaces and assign LL address(es)
- discover MANET Border Routers (MNBRs): (DHCP server discovery, FQDN lookup, routing protocol/cross-layer information, anycast, etc.)
- perform RS/RA exchange w/MNBR(s) over VET
Autoconfiguration Procedure (2)

- get DHCP prefix delegations (e.g., /64s, /128s, etc.) from MNBRs for assignment on loopback/ingress interfaces
- self-generate ULA/ULA-C prefixes for assignment on loopback and/or ingress interfaces (independent of other autoconfig steps)
- (TBD) auto-configure IPv6 addresses on VET interfaces using SLAAC based on prefixes in RAs (is this needed?)
- MNR can now:
  - select exit router(s)
  - send binding updates to home agents (if necessary)
  - tunnel packets with home network source addr to HA
  - send packets with visited network source addr on global scope
  - send packets with ULA/ULA-C source addr within site or between interconnected sites
Operation with Multiple MNBRs

- RFC4191 ("Default Router Preferences and More Specific Routes")
- Discovery of multiple MNBRs to be used as exit routers to get off the MANET
- MNR must use the MNBR it obtained its visited network prefix from as default:
  - MNBR may itself be a MR away from its home network, and delegating prefixes from its home prefix
- Further discussion on multiple MNBRs in draft section 3.1
MLA DAD Considerations

- MLAs assigned to MANET interfaces should be managed and/or statistically unique such that MANET-wide *pre-service DAD* not needed
- *in-service DAD* recommended to detect duplication due to partitions/merges/etc.
Other DAD Considerations

• No MANET-wide DAD needed for DHCP prefix delegation because each MNR receives unique prefix(es)
• No MANET-wide DAD needed for ULA/ULA-C due to statistical uniqueness
• No MANET-wide DAD needed for link-local addresses assigned to VET interface that are derived from MLA addresses
Drafts

• The combined draft:
  – draft-templin-autoconf-dhcp
• The virtual ethernet draft (update needed):
  – draft-templin-autoconf-virtual
• The multilink site draft (update needed):
  – draft-templin-autoconf-multilink
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Backups
VET Interface “Portals”

• enhanced portal (i.e., IP-in-IP encaps):
  – MANET appears as a unified shared link
  – TTL not decremented
  – all MRs are neighbors
  – standard ND works as-normal

• unenhanced portal (i.e., non-encaps)
  – MANET appears as a multilink site
  – TTL decremented
  – multiple IP hops between MRs
  – need a “site-scoped” equivalent of ND
VET input

```
+----------------------------------------+       ^
|                                       |       |
| ip_input()                             |       |
|                                       |       |
+----------------------------------------+       |
| virtual_ethernet_input()               |       |
|                                       |       |
| _ unenhanced portal ___ ___ enhanced portal ___ | a   |
| /            \                     \      | c   |
| - submit to ip_input() | - decapsulate packet | k   |
| | - submit to ip_input() | | e   |
| |                          | | t   |
| +-------------------------------+ | s   |
| | ip_input() |                |     |
+----------------------------------------+       |
| MANET Intf 0 | MANET Intf 1 | ... | MANET Intf n |       |
| (MLA 0)      | (MLA 1)      | ... | (MLA n)      |       |
```