Ad hoc network autoconfiguration: definition and problem statement
(draft-singh-autoconf-adp-00.txt)

Background

- Ad hoc node may need to autoconfigure either or both of:
  - Global scope address, if a gateway is available
  - MANET-local scope address, for standalone networks
- Current status:
  - No standard mechanism and definition related to autoconfiguration of ad hoc node
- MANET list has carried discussions of autoconfiguration ideas and requirements almost since [manet] was chartered.
- Has never been a charter item
- There have been several autoconfiguration drafts
  - None of them have been accepted as working group drafts
- Many outside projects (e.g., military) have shown the need

Other working groups

- Zeroconf
  - Took years to finish, even with product experience and great interest
  - Warnings about having special addresses treated differently by applications
  - Strong requirement to prevent addresses from escaping the local network; applications sometimes pass address references to distant computers
- IPv6 stateless autoconfiguration
  - Needs deployment experience with big populations
  - Must consider the experience and outcome of “site-local”
  - Can not, natively, work in multi-hop scenario
- DHC
  - But a DHCP approach may be unworkable

Definition (1/2)

Terms widely used but no standardized definition…

- MANET local address: valid only within the MANET
- MANET local prefix: to generate MANET local address
- Global address: routable on the Internet
- Standalone ad hoc network: MANET not connected to any other network
- Hybrid ad hoc network: MANET connected to infrastructured network (e.g., via one or more gateways)

Definitions (2/2)

- Network Merger: coming together of two or more stand alone MANET
- Network Partition: Disconnection of one MANET into multiple MANETs
- DAD: duplicate address detection – a protocol mechanism for insuring uniqueness of IP addresses
- GranDAD: duplicate address detection – a protocol mechanism for insuring uniqueness of IP addresses, even in the face of network merger
- Internet Gateway: a node which has connectivity to the Internet and enables a MANET to be reachable from the Internet (and vice versa) (sometimes, Gateway for short)

Problem statement (1/5)

- No standard specification describing how ad hoc node should autoconfigure IP address and undergo DAD

- Existing mechanisms e.g. RFCs 2461, 2462, 3315 etc. cannot immediately be used due to typical features of ad hoc networks:
  - Multi-hop packet forwarding
  - Infrastructure-less
  - Random mobility
  - Different concept of link

Problem statement (2/5)

Autoconf protocol should carefully distinguish between cases when:

- there is complete absence of any infrastructure
  - Standalone ad hoc network
- there is address and/or prefix allocation agency
  - Hybrid ad hoc network
- Switching between the above two
  - Intermittently connected network

Problem statement (3/5)

Standalone MANET

- Lack of any pre-established address or prefix allocation agency
- A node may leave/join network and/or randomly change its neighborhood
- Protocol solutions may involve multi-hop forwarding to a node that has no established IP address -- and no DHCP-like relay!

Problem statement (4/5)

- Hybrid ad hoc network
  - Internet gateway can act as prefix/address allocation agency
    - Allocation issue in the multi-hop scenario
    - DAD issue due to random network merger and partition
- Intermittently connected ad hoc network
  - Requires the various allocation modes to be compatible
- Ad hoc networks can also contain nodes that do not require any address to be allocated
  - But, must be able to communicate with nodes that have automatically configured addresses

Problem statement (5/5)

- Network merger & partition
  - inherent property of ad hoc network
  - may occur at any point of time
  - merger may result in address conflict
  - relevant to standalone as well as hybrid network

- Other autoconfiguration needs -- out of scope for this BOF?
  - Multicast addresses
  - Service discovery
  - DNS

Assumptions

- Nodes should be able to get IP addresses that conform to the characteristics of the IP addressing architecture
- If a connected manet has hierarchical substructure, the address allocated to nodes in a subhierarchy must fit the address range associated to that subhierarchy
- Internet gateways advertising connectivity to the same routing prefix must coordinate their routing tables
- Internet gateways may offer several different routing prefixes.
- When duplicate addresses are detected, at least one of the nodes must discontinue.
- The protocol should work regardless of underlying routing protocol
  - But, protocol features might offer significant optimizations
- Lifetimes for autoconfigured addresses
  - If lifetime expires, use of the address should immediately cease.

Potential design guidelines

- A node may choose which Internet gateway's routing prefix to use for autoconfiguration according to any convenient criterion, not necessarily constrained by the autoconf protocol
- Routes internal to the ad hoc network must not leak into the Internet.
  - Internet nodes cannot see past the Internet gateway
- A Internet gateway can be treated as a default router for the Internet.
- A Internet gateway should maintain routes for active nodes within the MANET
- An autoconf solution should take care of the following situations:
  - Address assignment
  - Network partitioning
  - Network merger
- Specification SHOULD fit in five pages