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 MANETs.
- **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
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