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Prefix Distribution Framework for Connected MANETs
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Abstract

Table of Contents

1. Introduction

Connected MANETs have connectivity to one or more external networks, typically the Internet, through one or more MNBR (MANET Border Router, see [2]). MANET routers may generate traffic destined to remote hosts across these external networks. This document gives a framework of autoconfiguration solutions for connected MANETs.

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [1].

2. Terminology

This document uses the MANET architecture and autoconfiguration problem state terminology defined in [2] and [3], as well as the following terms:

Edge router (ER): The router residing in the external network that maintains links with MANET nodes serving as the gateway between the MANET and external network.

Mobility Anchor Point (MAP): A physical or virtual entity to generate topologically correct prefix for Connected MANETs.

3. Problem Statement

Problem statement for Connected MANETs is given in [3]. We describe more specific problems to consider in this document as follows:

Suppose a MANET has one or more MNBRs and a MANET router needs to communicate with a remote host in the Internet via one of MNBRs (Fig. 1). To do this, the MANET router selects one of the MNBRs and configures a global address for each of its MANET interface using a prefix, that is advertised through the selected MNBR. The MANET router then starts to communicate with the remote host using the configured global address. When the selected MNBR leaves the MANET or it is no longer appropriate as the MNBR for the communication, the MANET router needs to discover a new MNBR to continue communication. If this new MNBR advertises a different prefix, the MANET router configures a new global address using the new prefix, resulting in address change. The address change also occurs, when a MANET has multiple MNBRs and a MANET router re-selects a better MNBR in terms of communication efficiency and a different prefix is advertised thorough this new MNBR.

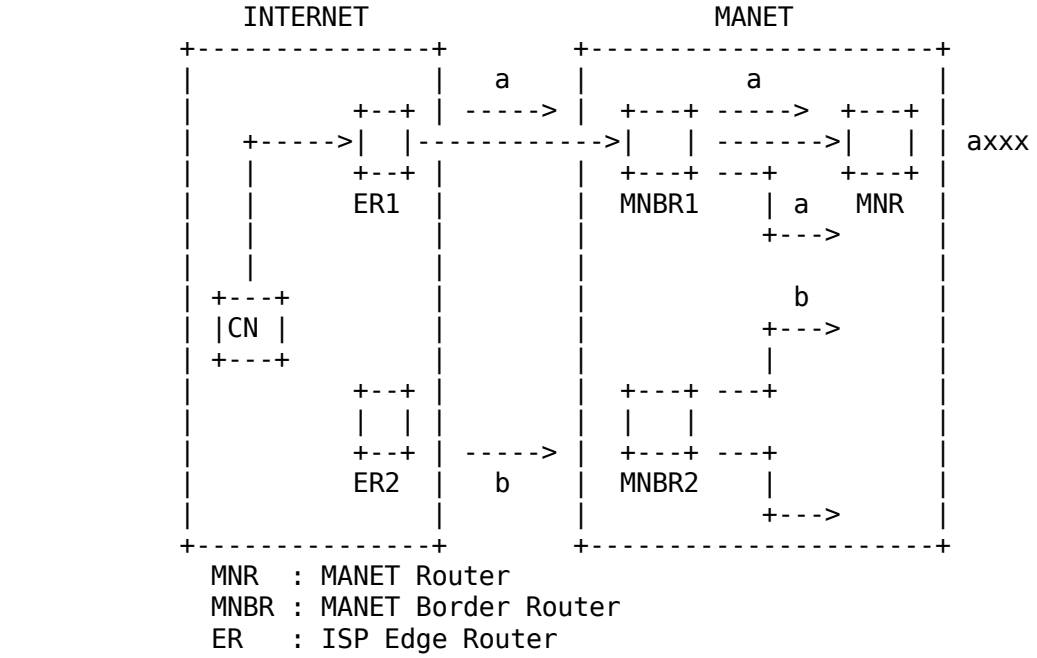


Fig. 1: The example of communication with a remote host in the Internet via one of MNBRs.

Such address change is harmful in two aspects. Firstly, any application sessions established between the MANET router in question

and the corresponding remote hosts in the Internet are obliged to be terminated, when address change occurs, and new application sessions need to be re-established between them to continue communications. Secondly, route entries based on old addresses in MANET routers become obsolete and route entry re-establishment based on new addresses is required. During route re-establishment, data packets forwarding may fail.

4. Prefix distribution

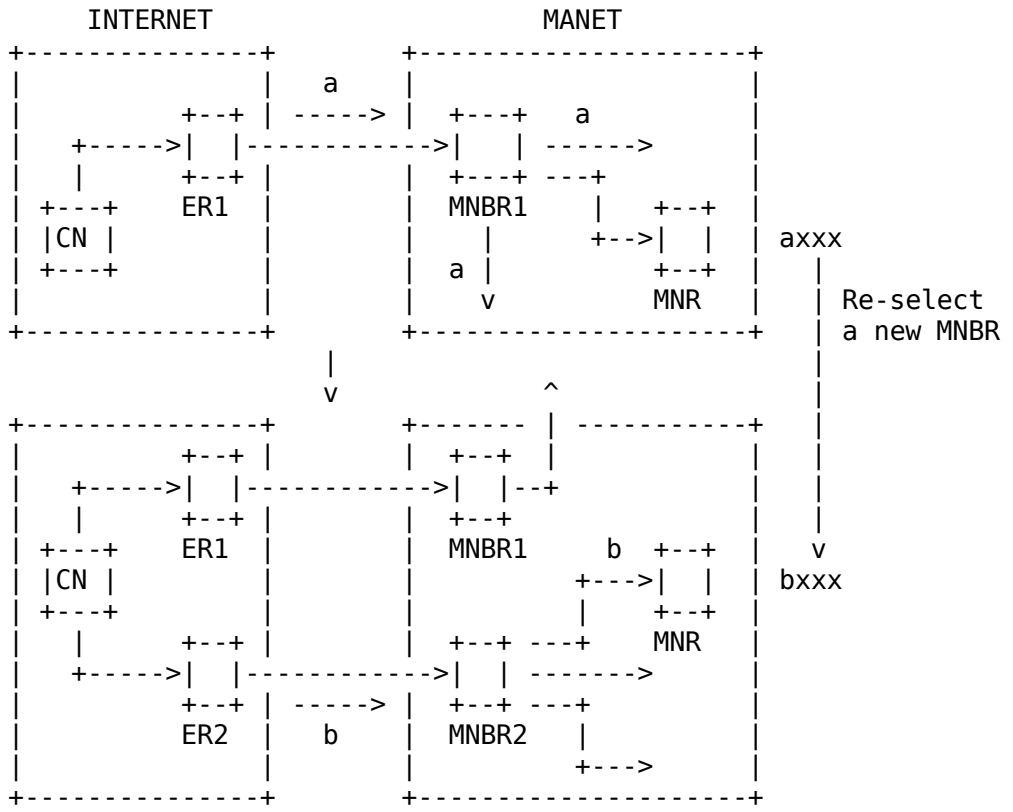
There are two schemes for advertising and distributing topologically correct global prefixes into a connected MANET, that is, Individual Prefix Distribution (IPD) [4]-[7] and Common Prefix Distribution (CPD) [8]-[9]. IPD and CPD are explained in Fig. 2 and Fig. 3, respectively.

In IPD, a topologically correct global prefixes are maintained and advertised by Edge Routers (ERs) and distributed via MNBRs, each of which is connected to the corresponding ER, into the MANET. Different ERs may advertise different global prefixes depending on their topological locations in the Internet.

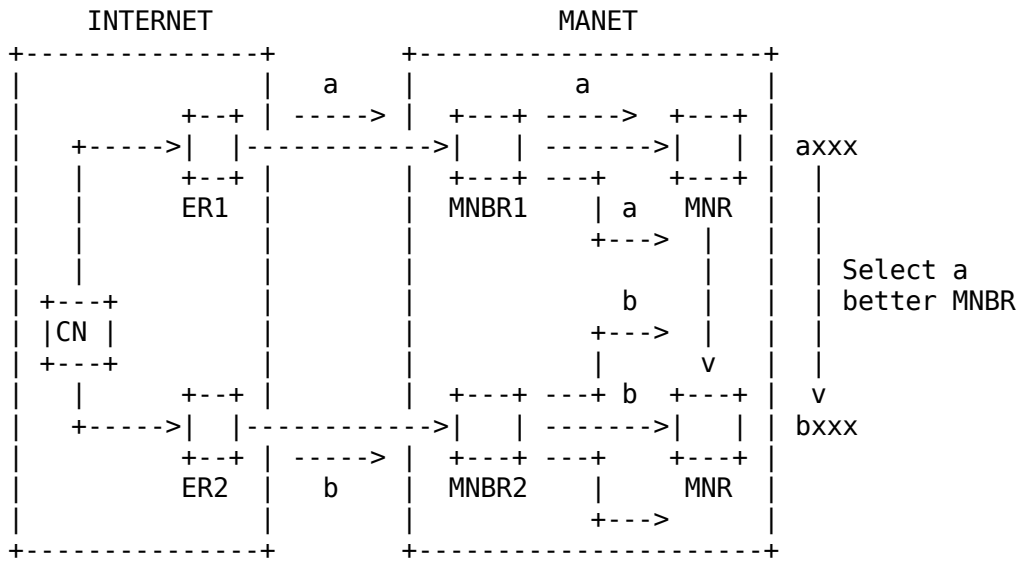
In Case I of Fig. 2, an MNR obtains the prefix a though MNBR1 and configures the address axxx to communicate with a CN. Later, MNBR1 leaves the MANET and MNR re-select a new MNBR2 and obtains the new prefix b to configure the address bxxx, thus address change occurs. In case of Fig.2, MNR itself roams in the MANET and select MNBR2 based on some metric such as the number of hops between MNR and MNBR. Again the address change from axxx to bxxx occurs.

In CPD, a global prefix is maintained and advertised by a Mobility Anchor Point (MAP) and distributed via ERs and the corresponding MNBRs into the MANET. The same global prefix is therefore distributed regardless of different MNBRs into the MANET.

In Fig. 3, the same prefix a is supplied to both ER1 and ER2 based on an appropriate mechanism such as use of the Moblity Anchor Point (MAP). an MNR obtains the prefix a through MNBR1 and configures the address axxx to communicate with a CN. Later, MNR roams and select MNBR2 for communication efficiency. MNR obtains the same prefix a through MNBR2 and thus can keep the same address axxx. No address change is required.



(Case I : The selected MNBR leaves)



(Case II : A MANET router roams)

MNR : MANET Router
MNBR : MANET Border Router
ER   : ISP Edge Router

Fig. 2: Individual Prefix Distribution Scheme

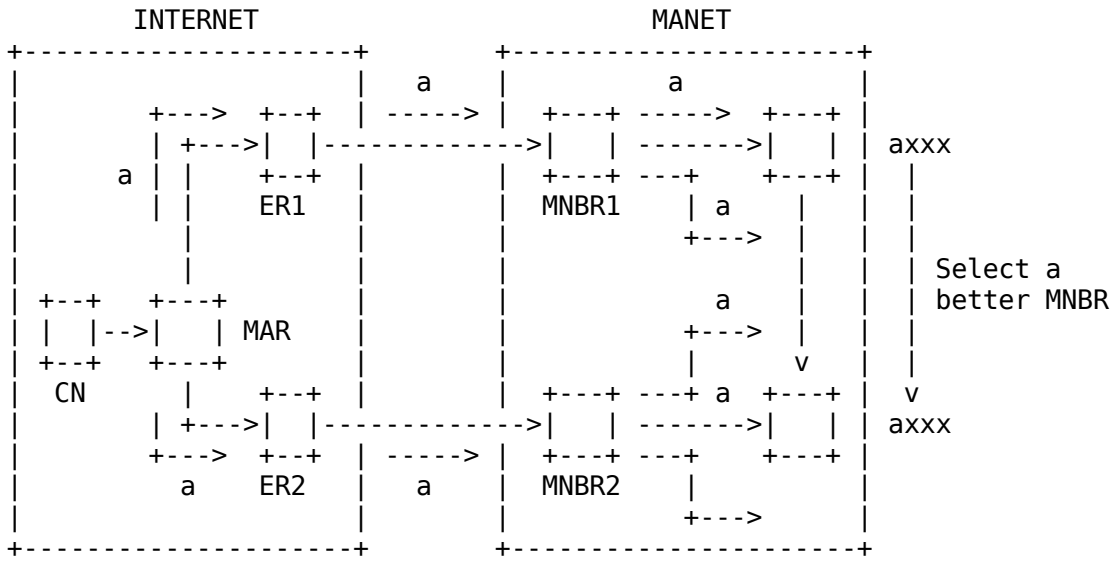


Fig. 3: Common Prefix Distribution Scheme

5. Evaluation

In IPD, a MANET router my change its global address when it re-selects a new MNBR, resulting in having route entries based on the old address obsolele. Route entries thus needs to be re-established in the MANET. To suppress route re-establishment, multiple address advertisement [6] or MANET-local address-based routing [7] may be used with additional overhead. Specifically, In the former, each node configures multiple care-of-addresses based on the received prefixes and advertises all of them throughout the MANET so that the routing protocol maintains all routes to the multiple addresses [6]. When a node changes its address to one of the advertised addresses, all other nodes already have maintained the route to this address. In the second approach, data packets are tunneled between the MANET routers and the selected MNBRs in both directions. MANET-local address is used for forwarding packets within the MANET [7]. As the result, no route re-establishment needs to be performed. However, these methods can't avoid address change. When address change occurs, application sessions are terminated and need to be re-established.

In CPD, address change does not occur, since the same global prefix is distributed into the MANET, regardless of the difference of MNBR. Application sessions continue to work, when a MANET router re-selects MNBR.

The evaluation is summarized in Table I.

Table I. The evaluation of prefix distribution schemes for connected MANETs.

	Address Change	Route Reconstruction In MANET	Remarks
Individual Prefix Distribution	Yes	Yes	Route reconstruction can be suppressed using, - Multiple address advertisement - MANET-local address based routing
Common Prefix Distribution	No	No	Mobility Anchor Point, fixedly or dynamically configured, may be necessary.

6. References

[1] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[2] I. Chakeres, J. Macker, T. Clausen, "Mobile Ad hoc Network Architecture", draft-ietf-autoconf-manetarch-07 (work in progress), November 2007.

[3] E. Baccelli, K. Mase, S. Ruffino, S. Shingh, "Address Autoconfiguration for MANET: Terminology and Problem statement", draft-ietf-autoconf-statement-01 (work in progress), August 2007.

[4] Wakikawa, R., J. T. Malinen, C. E. Perkins, A. Nilsson, and A. J. Tuominen, "Global Connectivity for Mobile Ad Hoc Networks", draft-wakikawa-manet-globalv6-04 (work in progress), July 2005.

[5] Jelger, C., T. Noel, and A. Fre, "Gateway and Address Autoconfiguration for IPv6 Ad Hoc Networks", draft-jelger-manet-gateway-autoconf-v6-02 (work in progress), April 2004.

[6] Ruffino, S. and P. Stupar, "Automatic Configuration of IPv6 Addresses for noes in a MANET with Mutiple Gateways", draft-ruffino-manet-autoconf-multigw-01 (work in progress), December 2005.

[7] Hofmann, P., "Multihop Radio Access Network (MRAN) Protocol Specification", draft-hofmann-autoconf-mran-00 (work in progress), March 2006.

[8] F. Templin, S. Russert, I. Chakeres, S. Yi, "MANET Autoconfiguration", draft-templin-autoconf-dhcp-09 (work in progress), September 2007.

[9] K.Mase, Y.Owada, "Gateway Aggregation Protocol (GAP) for Mobile Ad hoc Networks", draft-mase-autoconf-gap-01 (work in progress), July 2007.

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