NETWORK Working Group
INTERNET-DRAFT
Category: Informational
<draft-akinlar-zeroconf-multirouter-01.txt>
Research August 15 2000

Cuneyt Akinlar
David Braun
Sarit Mukherjee
Panasonic

Multi-Router Zeroconf Network Requirements

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of Section 10 of RFC2026.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts. Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at http://www.ietf.org/ietf/1id-abstracts.txt

The list of Internet-Draft Shadow Directories can be accessed at http://www.ietf.org/shadow.html.

The distribution of this memo is unlimited. It is filed as <draft-akinlar-zeroconf-multirouter-00.txt>, and expires February 15, 2001. Please send comments to the authors.

Abstract

Zero Configuration (Zeroconf) Networks are a particular class of TCP/IP networks that may be established in the home, in small offices or even for a variety of adhoc purposes. Zeroconf networks do not have and should not be expected to have user configurable network infrastructure such as DHCP, DNS and other administered network services. This is because typical zeroconf network users neither have the skill nor the desire to configure, administer or manage a network [1].

The IETF Zeroconf Requirements draft [1] presents the zeroconf protocol requirements for 4 areas: IP host configuration, domain name to IP address resolution, IP multicast address allocation, and service discovery. This draft builds on [1] and lists the zeroconf protocol requirements for IP router configuration and dynamic routing protocol in multi-router zeroconf networks.

Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [6].

1. Introduction

Zero Configuration (Zeroconf) Networks are a particular class of TCP/IP networks that may be established in the home, in small offices or on an adhoc basis . IETF Zeroconf Requirements draft [1] presents the zeroconf protocol requirements for 4 areas: IP host configuration, domain name to IP address resolution, IP multicast address allocation, and service discovery. IP router configuration requirements are not addressed in [1].

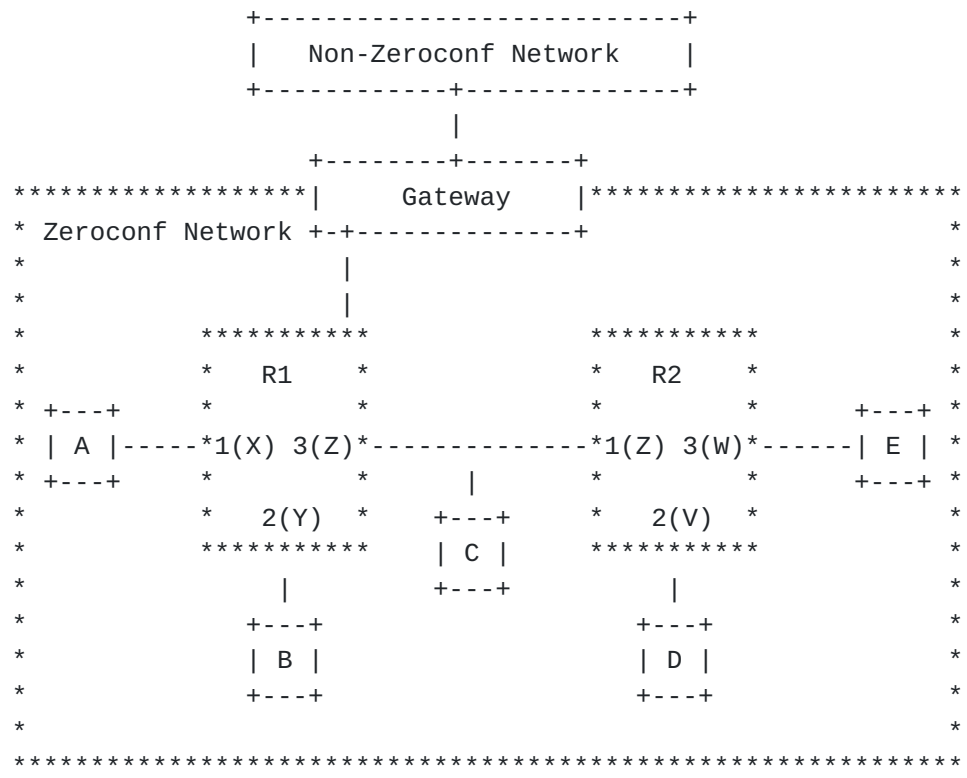

Figure 1: A zeroconf network with 2 routers and a gateway

Figure 1 shows a typical multi-router zeroconf network consisting of 2 internal zeroconf routers and 1 zeroconf gateway connecting the zeroconf network to the Internet. The zeroconf network consists of 5 IP segments. A zeroconf gateway is defined in [1] to be a specialized router. It restricts packets that pass between the Zeroconf and non-zeroconf networks to ensure autonomy of the zeroconf network and to avoid many security problems. The gateways SHOULD act as boundary routers as

defined in RFC 2365.

In this document, we present the zeroconf protocol requirements for IP router configuration and dynamic routing protocols in multi-router zeroconf networks such as the one in Figure 1. The IP host configuration protocol requirements as defined in [1] directly apply to this environment. Therefore, we do not list them here.

Before we list the requirements, we define some terms used in this draft:

A segment: A link-layer or several link-layer networks connected by bridges. In a segment all hosts can communicate with each other using only MAC addresses.

IP Subnet: Hosts who share the same subnet number of their IP addresses constitute an IP subnet. The subnet number of an IP address is found by ANDing the IP address with the netmask.

2. IP router Configuration Protocol Requirements

Requirements for IP Router Configuration Protocol are the following:

(1) Routers MUST configure an IP address for each of their interfaces.
(2) Routers MUST configure a netmask for each of their interfaces.
(3) The network number (subnet number) of all IP subnets within the zeroconf network MUST be unique.
(4) The host number of an interface IP address MUST be unique within a single IP subnet.

As Figure 1 shows, each segment in the zeroconf network MUST have a unique subnet number. In the Figure, R1 has assigned unique subnet numbers X, Y and Z to its interfaces 1, 2 and 3 respectively. Similarly, R2 has assigned subnet numbers Z, V, and W to its interfaces 1, 2 and 3. In an administered network the shared segments are usually assigned the same subnet number at all the routers sharing the segment. In the figure, both R1 and R2 have assigned subnet number Z to the shared segment. Howeverm this is not a requirement. The network will work correctly even if the routers assign different subnet numbers to the shared segment provided that the routers know about all subnets in the network through dynamic routing. So:

(5) A shared segment between multiple routers SHOULD be assigned the same subnet number.

Since subnet numbers must be unique within the zeroconf network:

(6) Routers MUST be able to detect subnet conflicts (use of the same subnet number for different physical segments) and resolve them.
(7) Routers MUST be able to re-configure their IP address and netmask after new routers are connected to the network.

When multiple routers are connected together, there might be subnet number conflicts. Requirements (6) & (7) state that these conflicts MUST be detected and resolved as new routers are added to the network.

3. Dynamic Routing Protocols

In administered networks, routers use dynamic routing protocols such as RIP [2-3] and OSPF [4] to communicate with each other to exchange routing information. This allows routers in the network learn about all subnets in the network so that hosts in any part of the network can communicate with each other. The routers within the network will route the packets from the source to the destination using the information that they obtain from the dynamic routing protocol. In zeroconf networks consisting of multiple routers, dynamic routing must also be performed. The requirements for the zeroconf dynamic routing protocols are the following:

(1) Routers MUST learn about all the existing subnets in the zeroconf network.
(2) Routers MUST learn about new subnets when they are connected to the zeroconf network.
(3) Routers MUST learn that some routes do not exist in the zeroconf network anymore when those routes are removed from the zeroconf network.
(4) Routers MAY use dynamic routing protocols to detect and resolve subnet conflicts.
(5) If routers use a zeroconf dynamic routing protocol both to advertise routes and to detect and resolve subnet number conflicts, then the zeroconf dynamic routing protocol MUST NOT coexist with an administered routing protol on the zeroconf network.

4. References:

[1] M. Hatting, Zeroconf Requirements, draft-ietf-zeroconf-reqts-03.txt, March 2000. A work in progress.

[2] C. Hedrick, Routing Information Protocol, RFC 1058, June 1988.

[3] G. Malkin, RIP Version 2, RFC 2453, November 1998.

[4] J. Moy, OSPF Version 2, RFC 2328, April 1998.

[5] Bernard Aboba, Auto-Addressing in Multi-segment Networks, draft-aboba-zeroconf-multi-00.txt, Oct 1999. A work in progress.

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

4. Authors' Addresses

Cuneyt Akinlar
Panasonic Research
2 Research Way
Princeton NJ 08540
Phone: +1 (609) 734-7356
EMail: akinlar@research.panasonic.com

David Braun
Panasonic Research
2 Research Way
Princeton NJ 08540
Phone: +1 (609) 734-7322
EMail: braun@research.panasonic.com

Sarit Mukherjee
Panasonic Research
2 Research Way
Princeton NJ 08540
Phone: +1 (609) 734-7347
EMail: sarit@research.panasonic.com