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F. Zheng
B. Wu, Ed.
Huawei
R. Wilton, Ed.
Cisco Systems
F. Zhang, Ed.
Y. Zhu
China Telecom
X. Ding

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A YANG Data Model for ARP Extensions
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Abstract

This document defines a YANG data model for the management of the Address Resolution Protocol (ARP). It extends the basic ARP functionality contained in the ietf-ip YANG data model, defined in RFC 8344, to provide management of optional ARP features and statistics.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on 15 October 2026.

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1. Introduction

Basic ARP functionality is supported by the ietf-ip YANG data model, defined in [RFC8344]. This document defines a YANG [RFC7950] data model that extends the basic ARP YANG support to also cover optional ARP features, and ARP-related statistics to aid network monitoring and troubleshooting.

This model defines YANG configuration and operational state data nodes both for ARP related functionality formally specified in other RFCs (such as [RFC8344] and [RFC1027]), and also for common ARP behaviour that is often supported on network devices.

The YANG modules in this document conform to the Network Management Datastore Architecture (NMDA) [RFC8342].

Editorial Note: (To be removed by RFC Editor)

This draft contains several placeholder values that need to be replaced with finalized values at the time of publication. Please apply the following replacements:

* "XXXX" --> the assigned RFC value for this draft both in this draft and in the YANG models under the revision statement.

* The "revision" date in model, in the format XXXX-XX-XX, needs to be updated with the date the draft gets approved. The date also needs to get reflected on the line with <CODE BEGINS>.

1.1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

The following terms are defined in [RFC8342] and are not redefined here:

* client

* server

* configuration data

* system state

* state data

* intended configuration

* running configuration datastore

* operational state datastore

The following terms are defined in [RFC7950] and are not redefined here:

* augment

* data model

* data node

The terminology for describing YANG data models is found in [RFC7950].

1.2. Tree Diagrams

Tree diagrams used in this document follow the notation defined in [RFC8340] .

2. Problem Statement

Neither ARP [RFC0826] nor Proxy-ARP [RFC1027] defines standard network management configuration models. Instead, network equipment vendors have implemented their own bespoke configuration interfaces and models.

Network operators benefit from having common network management models defined that can be implemented by multiple network equipment manufacturers. This simplifies the operation and management of network devices.

Some, but not all, required ARP functionality has been defined in "ietf-ip" ([RFC8344]). Providing a standard YANG model that models these optional ARP features, which are fairly widely implemented by network equipment manufacturers, and used by network operators, is beneficial to the general goal of interoperability in the networking industry.

3. Design of the Data Model

This data model intends to describe the processing that a protocol finds the hardware address, also known as Media Access Control (MAC) address, of a host from its known IP address. These tasks include, but are not limited to, configuring dynamic ARP learning, proxy ARP, and gratuitous ARP.

3.1. ARP Dynamic Learning

As defined in [RFC0826], ARP caching is the method of storing network addresses and the associated data-link addresses in memory for a period of time as the addresses are learned. This minimizes the use of valuable network resources to broadcast for the same address each time a datagram is sent.

There are static ARP cache entries and dynamic ARP cache entries. Static entries, are manually configured and kept in the cache table on a permanent basis which are defined in the ipv4 neighbor list for each interface in [RFC8344]. Dynamic entries are added by vendor software, kept for a period of time, and then removed. We can specify how long an entry remains in the ARP cache. If we specify a timeout of 0 seconds, entries are never cleared from the ARP cache.

The list of ARP cache entries and the configuration of static entries are already defined in "ietf-ip" module [RFC8344], which models each neighbor entry by the IPv4 address, link-layer address, and the origin of the entry (e.g., dynamic or static). And this ARP module extends the ARP cache entries by adding the remaining lifetime for the dynamic entries. Specifically, it augments the "/if:interfaces/if:interface/ip:ipv4/ip:neighbor" list with a "remaining-expiry-time" leaf.

3.2. Proxy ARP

Proxy ARP, defined in [RFC1027], allows a router to respond to ARP requests on behalf of another machine that is not on the same local subnet, offering its own Ethernet media access control (MAC) address. By replying in such a way, the router then takes responsibility for routing packets to the intended destination.

In the case of certain data center network virtualization, as specified in [RFC8014], the proxy ARP can be extended to intercept all ARP requests, including source and target IP addresses in different subnets, and those ARP requests in the same subnet to suppress ARP handling.

The ARP module defined a "proxy-arp" container that augments "ietf-ip" module [RFC8344] to support proxy ARP configuration on the interface. The container includes a "mode" leaf to control whether proxy ARP are enabled for all requests, only for targets in different subnets, or disabled.

3.3. Gratuitous ARP

Gratuitous ARP enables a device to send an ARP Request packet using its own IP address as the destination address. Gratuitous ARP provides the following functions:

* Checks duplicate IP addresses: [RFC5227] uses gratuitous ARP to help detect IP conflicts. When a device receives an ARP request containing a source IP that matches its own, then it knows there is an IP conflict.

* Advertises a new MAC address: Also in [RFC5227], if the MAC address of a host changes because its network adapter is replaced, the host sends a gratuitous ARP packet to notify all hosts of the change before the ARP entry is aged out.

* Notifies an active/standby switchover in a [RFC9568] VRRP backup group: After an active/standby switchover, the master router sends a gratuitous ARP packet in the VRRP backup group to notify the switchover.

The ARP module defined a "gratuitous-arp" container that augments "ietf-ip" module [RFC8344] to support gratuitous ARP configuration. The container includes an "enable" leaf to control whether gratuitous ARP packets are sent on the interface, and an "interval" leaf to specify the time between sending gratuitous ARP packets.

3.4. ARP Data Model

This document defines the YANG module "ietf-arp-extension", which has the following structure:

```
module: ietf-arp-extension

  augment /if:interfaces/if:interface/ip:ipv4:
    +--rw arp
       +--rw expiry-time?        uint32
       +--rw dynamic-learning?   boolean
       +--rw proxy-arp
       |  +--rw mode?   enumeration
       +--rw gratuitous-arp
       |  +--rw enabled?    boolean
       |  +--rw interval?   uint32
       +--ro statistics
          +--ro in-requests-pkts?      yang:counter64
          +--ro in-replies-pkts?       yang:counter64
          +--ro in-gratuitous-pkts?    yang:counter64
          +--ro out-requests-pkts?     yang:counter64
          +--ro out-replies-pkts?      yang:counter64
          +--ro out-gratuitous-pkts?   yang:counter64
  augment /if:interfaces/if:interface/ip:ipv4/ip:neighbor:
    +--ro remaining-expiry-time?   uint32
```

4. ARP YANG Module

This section presents the ARP YANG module defined in this document.

This module imports definitions from Common YANG Data Types [RFC9911], A YANG Data Model for Interface Management [RFC8343], and A YANG Data Model for IP Management [RFC8344].

<CODE BEGINS> file "ietf-arp-extension@2026-04-07.yang"

```
module ietf-arp-extension {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-arp-extension";
  prefix arp-ext;

  import ietf-yang-types {
    prefix yang;
    reference
      "RFC 9911: Common YANG Data Types";
  }
  import ietf-interfaces {
    prefix if;
    reference
      "RFC 8343: A Yang Data Model for Interface Management";
  }
  import ietf-ip {
    prefix ip;
    reference
      "RFC 8344: A Yang Data Model for IP Management";
  }

  organization
    "IETF Internet Area Working Group (intarea)";
  contact
    "WG Web:  <https://datatracker.ietf.org/wg/intarea/>
     WG List: <mailto:int-area@ietf.org>

     Author:  Feng Zheng
              <habby.zheng@huawei.com>
     Editor:  Bo Wu
              <lana.wubo@huawei.com>
     Editor:  Robert Wilton
              <rwilton@cisco.com>
     Editor:  Fan Zhang
              <zhangf52@chinatelecom.cn>
     Author:  Yongqing Zhu
              <zhuyq8@chinatelecom.cn>
     Author:  Xiaojian Ding
              <wjswsl@163.com>";
  description
    "This YANG module extends Address Resolution Protocol (ARP)
     configuration and management defined in the ietf-ip, which
     includes dynamic ARP learning, proxy ARP, gratuitous ARP,
```

```
        and packet statistics collection.

        Copyright (c) 2026 IETF Trust and the persons identified as
        authors of the code.  All rights reserved.

        Redistribution and use in source and binary forms, with or
        without modification, is permitted pursuant to, and subject
        to the license terms contained in, the Revised BSD License set
        forth in Section 4.c of the IETF Trust's Legal Provisions
        Relating to IETF Documents
        (https://trustee.ietf.org/license-info).

        This version of this YANG module is part of RFC XXXX; see the
        RFC itself for full legal notices.";

      revision 2026-04-07 {
        description
          "Initial version.";
        reference
          "RFC XXXX: A YANG Data Model for ARP Extensions";
      }

      /* Data nodes */

      augment "/if:interfaces/if:interface/ip:ipv4" {
        description
          "Augment interfaces with ARP configuration and state.";
        container arp {
          description
            "Address Resolution Protocol (ARP) related configuration
             and state";
          leaf expiry-time {
            type uint32 {
              range "30..86400";
            }
            units "seconds";
            description
              "Aging time of a received dynamic ARP entry before it is
               removed from the cache.";
          }
          leaf dynamic-learning {
            type boolean;
            default "true";
            description
              "Controls whether dynamic ARP learning is enabled on the
               interface.

                 true -  dynamic learning is enabled
```

```
            false - dynamic learning is disabled";
        }
        container proxy-arp {
          description
            "Configuration parameters for proxy ARP";
          leaf mode {
            type enumeration {
              enum disabled {
                description
                  "The system only responds to ARP requests that
                   specify a target address configured on the local
                   interface.";
              }
              enum remote-only {
                description
                  "The system only responds to ARP requests when the
                   sender and target IP addresses are in different
                   subnets.";
              }
              enum all {
                description
                  "The system responds to ARP requests where the sender
                   and target IP addresses are in different subnets, as
                   well as those where they are in the same subnet.";
              }
            }
            default "disabled";
            description
              "When set to a value other than 'disabled', the local
               system should respond to ARP requests that are for
               target addresses other than those that are configured on
               the local subinterface using its own MAC address as the
               target hardware address.  If the 'remote-only' value is
               specified, replies are only sent when the target address
               falls outside the locally configured subnets on the
               interface, whereas with the 'all' value, all requests,
               regardless of their target address are replied to.";
            reference
              "RFC1027: Using ARP to Implement Transparent Subnet
               Gateways";
          }
        }
        container gratuitous-arp {
          description
            "Configure gratuitous ARP.";
          reference
            "RFC5227: IPv4 Address Conflict Detection";
          leaf enabled {
```

```
            type boolean;
            description
              "Enable or disable sending gratuitous ARP packet on the
               interface.

               The default behaviour is device specific, and a
               deviation could be used to specify a device specific
               default.";
          }
          leaf interval {
            type uint32 {
              range "1..86400";
            }
            units "seconds";
            description
              "The interval, in seconds, between sending gratuitous ARP
               packets on the interface.

               The default behaviour is device specific, and a
               deviation could be used to specify a device specific
               default.";
          }
        }
        container statistics {
          config false;
          description
            "ARP per-interface packet statistics

             For all ARP interface counters, discontinuities in the
             value can occur at re-initialization of the management
             system and at other times as indicated by the value of
             '../../statistics/discontinuity-time' in the
             ietf-interfaces YANG module.";
          leaf in-requests-pkts {
            type yang:counter64;
            description
              "The number of ARP request packets received on this
               interface.";
          }
          leaf in-replies-pkts {
            type yang:counter64;
            description
              "The number of ARP reply packets received on this
               interface.";
          }
          leaf in-gratuitous-pkts {
            type yang:counter64;
            description
```

```
              "The number of gratuitous ARP packets received on this
               interface.";
          }
          leaf out-requests-pkts {
            type yang:counter64;
            description
              "The number of ARP request packets sent on this
               interface.";
          }
          leaf out-replies-pkts {
            type yang:counter64;
            description
              "The number of ARP reply packets sent on this
               interface.";
          }
          leaf out-gratuitous-pkts {
            type yang:counter64;
            description
              "The number of gratuitous ARP packets sent on this
               interface.";
          }
        }
      }
    }

    augment "/if:interfaces/if:interface/ip:ipv4/ip:neighbor" {
      description
        "Augment IPv4 neighbor list with ARP expiry time.";
      leaf remaining-expiry-time {
        type uint32;
        units "seconds";
        config false;
        description
          "The number of seconds until the dynamic ARP entry expires
           and is removed from the ARP cache.";
      }
    }
  }
  <CODE ENDS>
```

5. IANA Considerations

This document registers a URI in the IETF XML registry [RFC3688]. Following the format in [RFC3688], the following registration is requested to be made:

URI: urn:ietf:params:xml:ns:yang:ietf-arp-extension
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

This document registers a YANG module in the YANG Module Names registry [RFC6020].

Name: ietf-arp-extension
Namespace: urn:ietf:params:xml:ns:yang:ietf-arp-extension
Prefix: arp-ext
Reference: RFC XXXX

6. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040] . The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC8446].

The NETCONF Access Control Model (NACM) [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in this YANG module that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) and delete operations to these data nodes without proper protection or authentication can have a negative effect on network operations.These are the subtrees and data nodes and their sensitivity/vulnerability in the "ietf-arp-extension" module:

* /if:interfaces/if:interface/ip:ipv4/arp-ext:arp/arp-ext:dynamic-learning

This leaf is used to enable ARP dynamic learning on a single interface. ARP dynamic learning could allow an attacker to inject spoofed traffic into the network, e.g. denial-of-service attack.

* /if:interfaces/if:interface/ip:ipv4/arp-ext:arp/arp-ext:proxy-arp

These leaves are used to enable proxy ARP on an interface. They could allow traffic to be mis-configured (denial-of-service attack).

* /if:interfaces/if:interface/ip:ipv4/arp-ext:arp/arp-ext:gratuitous-arp

These leaves are used to enable sending gratuitous ARP packet on an interface. This configuration could allow an attacker to inject spoofed traffic into the network, e.g. man-in-the-middle attack. The default value for this data node is device specific, and hence users of this model MUST understand whether or not gratutious ARP is enabled and whether this could constitute a security risk.

7. Acknowledgments

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Appendix A. Data Model Examples

This section presents two ARP configuration examples using the ARP extension module, ietf-interfaces module [RFC8343] , and ietf-ip module [RFC8344] :

A.1. Configuration of a Static ARP Entry

This example illustrates the configuration for a static ARP entry for peer 192.0.2.1 with MAC address 00:00:5E:00:53:AB.

```
<?xml version="1.0" encoding="utf-8"?>
<interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces"
  xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-type">
  <interface>
    <name>eth0</name>
    <type>ianaift:ethernetCsmacd</type>
    <ipv4 xmlns="urn:ietf:params:xml:ns:yang:ietf-ip">
      <neighbor>
        <ip>192.0.2.1</ip>
        <link-layer-address>00:00:5E:00:53:AB</link-layer-address>
      </neighbor>
    </ipv4>
  </interface>
</interfaces>
```

A.2. Configuration of Proxy ARP and Gratuitous ARP

This example illustrates the configuration of ARP entry expiry time, proxy ARP in 'remote-only' mode, and enabling gratuitous ARP with an interval of 10 minutes.

```
<?xml version="1.0" encoding="utf-8"?>
<interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces"
  xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-type">
  <interface>
    <name>eth0</name>
    <type>ianaift:ethernetCsmacd</type>
    <ipv4 xmlns="urn:ietf:params:xml:ns:yang:ietf-ip">
      <arp xmlns="urn:ietf:params:xml:ns:yang:ietf-arp-extension">
        <expiry-time>1200</expiry-time>
        <dynamic-learning>true</dynamic-learning>
        <proxy-arp>
          <mode>remote-only</mode>
        </proxy-arp>
        <gratuitous-arp>
          <enabled>true</enabled>
          <interval>600</interval>
        </gratuitous-arp>
      </arp>
    </ipv4>
  </interface>
</interfaces>
```

Authors' Addresses

Feng Zheng
Huawei
101 Software Avenue, Yuhua District
Nanjing
Jiangsu, 210012
China
Email: habby.zheng@huawei.com

Bo Wu (editor)
Huawei
Email: lana.wubo@huawei.com

Robert Wilton (editor)
Cisco Systems
Email: rwilton@cisco.com

Fan Zhang (editor)
China Telecom
Email: zhangf52@chinatelecom.cn

Yongqing Zhu
China Telecom
Email: zhuyq8@chinatelecom.cn

Xiaojian Ding
Email: wjswsl@163.com