            Multicast Considerations for Gateway-Initiated Dual-Stack Lite
                    draft-brockners-softwire-mcast-gi-ds-lite-00

Abstract

   This document discusses multicast deployment aspects for networks
   which leverage Gateway-Initiated Dual-Stack lite.

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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   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on April 21, 2011.

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1. Introduction and Overview

   This draft discusses the deployment aspects for IPv4-Multicast in
   networks using Gateway-Initiated Dual-Stack lite (GI-DS-lite)
   [I-D.ietf-softwire-gateway-init-ds-lite]. GI-DS-lite is a modified
   approach to the original Dual-Stack lite (DS-lite)
   [I-D.ietf-softwire-dual-stack-lite] applicable to certain tunnel-
   based access architectures. Figure 1 shows an example. GI-DS-lite
   extends existing access tunnels beyond the Gateway to an IPv4-IPv4
   NAT device (as shown in Figure 2) using softwires with an embedded
   context identifier, that uniquely identifies the end-system the
   tunneled packets belong to. The Gateway determines which portion of
   the traffic requires NAT using local policies and sends/receives this
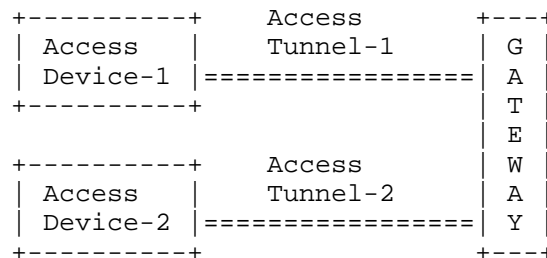   portion to/from this softwire tunnel.

```
            +----------+     Access        +---+
            | Access   |     Tunnel-1      | G |
            | Device-1 |=================| A |
            +----------+                   | T |
                                           | E |
            +----------+     Access        | W |
            | Access   |     Tunnel-2      | A |
            | Device-2 |=================| Y |
            +----------+                   +---+
```

            Figure 1: Tunnel based access architecture


```
  +----------+     Access        +---+
  | Access   |     Tunnel-1      | G |
  | Device-1 |=================| A |                +---------------+
  +----------+                   | T |                | Address       |
                                 | E |  Softwire-Tunnel | Family        |
  +----------+     Access        | W |=================| Transition    |
  | Access   |     Tunnel-2      | A |                | Router (AFTR) |
  | Device-2 |=================| Y |                +---------------+
  +----------+                   +---+
```
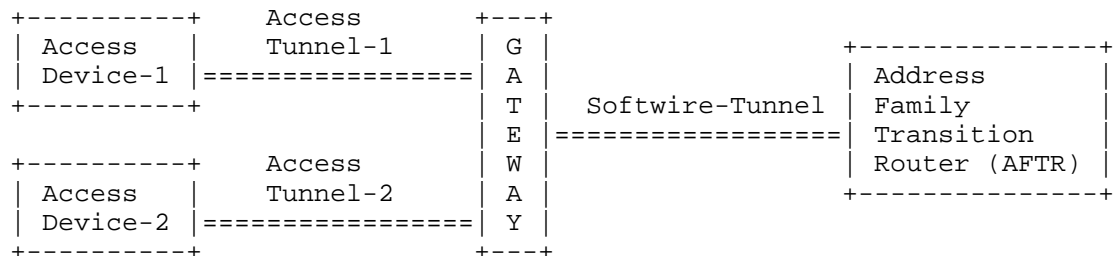
   Figure 2: Gateway-initiated dual-stack lite reference architecture

   Some applications require multicast to deliver services to the access
   devices. For example: Live sport event and IP-TV broadcast could use
   multicast to deliver video streams to the access devices. During
   IPv4-IPv6 transitioning, the multicast traffic could continue to be
   transported over IPv4, access devices behind GI-DS-lite require an
   architecture to subscribe to IPv4-Multicast groups and receive IPv4-

Multicast traffic. Currently, most IPv4-Multicast deployments
require the access devices to receive multicast traffic but not to
source multicast traffic. This memo considers the scenario where the
access device subscribes an IPv4-Multicast group and recommends how
the multicast routing could be done. The following cases are out of
scope in this memo:

o IPv4-Multicast sourced by Access Devices.

o Network Address Translation (NAT) for IPv4-Multicast traffic.

2. Abbreviations

The following abbreviations are used within this document:

AFTR: Address Family Transition Router (also known as "Large Scale
NAT (LSN)" or "Dual-Stack lite Tunnel Concentrator", or "Carrier
Grade NAT (CGN)"). An AFTR combines IP-in-IPv6 tunnel termination
and IPv4-IPv4 NAT.

DS-lite: Dual-stack lite

GI-DS-lite: Gateway-initiated DS-lite

NAT: Network Address Translation

3. Multicast Deployment Considerations

This section details the IPv4-Multicast deployment considerations for
GI-DS-lite. Several networks which follow the architecture shown in
Figure 1 above deploy IPv4-Multicast. If GI-DS-lite is introduced,
the Gateway continues to perform the role of the first hop IPv4-
Multicast router and the overall multicast distribution architecture
is left unchanged. Deployment dependent, the introduction of GI-DS-
lite could go hand in hand with the Gateway no longer having native
IPv4-Multicast connectivity. If the Gateway does not have native
IPv4-Multicast connectivity it should create a tunnel (e.g. IP-in-
IPv6 or IP-over-GRE6) to an IPv4-Multicast router (e.g. the closest).
The Gateway peers with that IPv4-Multicast router via the tunnel to
join the IPv4-Multicast routing domain.

3.1. Architectural Attributes

Deployment details for IP-Multicast are defined for several
architectures which leverage tunnel-based access, such as [TR101] for
DSL-Broadband, 3GPP TS 23.246 for mobile Multimedia Broadcast Service

(MBMS) [TS23246], or [I-D.ietf-multimob-pmipv6-base-solution] for
multicast in Proxy Mobile-IP deployments). Multicast in mobile or
broadband deployments with tunnel based access architectures share a
set of common architectural attributes:

o Subscribers are able to receive IP multicast, but are not assumed
   to send IP multicast (inline with the scope of this document).

o The Gateway is an IP-Multicast router, which is attached to the
   IP-Multicast distribution network of the service provider.

o Architectures often include devices which perform IGMP/MLD
   snooping and proxy reporting between the access device and the
   Gateway. Proxy Mobile IPv6 deployments
   [I-D.ietf-multimob-pmipv6-base-solution] are an example: Mobile
   devices (i.e. the Access Devices) are connected via a Mobile
   Access Gateway (MAG) implementing an IGMP proxy function to the
   Local Mobility Anchor (LMA) which performs the role of the
   Gateway.

o In several broadband multicast deployments IP-Multicast traffic is
   not forwarded over the access tunnels used for unicast traffic,
   but uses an alternate vehicle, which allows for traffic
   replication between access devices and Gateway. DSL-broadband
   networks with Ethernet aggregation are an example: While unicast
   traffic is forwarded between the access devices and the Broadband
   Network Gateway (BNG) over dedicated point to point VLANs, a
   separate VLAN is used to forward multicast traffic. This allows
   taking advantage of the multicast replication capabilities of
   Ethernet within the aggregation network.

3.2. Overlapping private IPv4 addresses

   GI-DS-lite supports deployments with (potentially overlapping) IPv4
   addresses assigned to the access devices. This could present
   challenges from a theoretical point of view for the following
   scenarios:

   1. The network deploys Source Specific Multicast (SSM) and IP-
       multicast is sourced from an access device: Per the note above,
       this scenario is out of the scope of this document.

   2. The network deploys IGMPv3 and leverages explicit tracking (see
       appendix 2 of [RFC3376], or appendix 2 of [RFC3810]) only based
       on the source IP address of the IGMP messages: Explicit tracking
       is in use by several networks today, though one often does not
       rely (only) on the source IP-address to identify different hosts.
       Several multicast networks deploy devices performing IGMP

snooping with proxy reporting between the multicast host and the
first hop IP-Multicast router. In those deployments, the source
IP address of the IGMP join messages does no longer represent the
multicast host. The Broadband Forum, for example, requires the
source IP address of IGMP packets sent by the proxy reporting
function to be 0.0.0.0 [TR101]. If explicit tracking is still
desired in those environments, identifiers other than the source
IP address need to be considered. Depending on the deployment
and architecture, those could for example be the interface (as
recommended for proxy Mobile-IP multicast deployments
[I-D.ietf-multimob-pmipv6-base-solution]) or the MAC-address (see
[TR101]), an access tunnel identifier etc.).

3.3. Considerations for the Gateway and AFTR

The Gateway's role with regards to IPv4-Multicast traffic forwarding
and routing does not change if GI-DS-lite is deployed within the
network and multicast traffic bypasses the AFTR. For deployments
which require explicit tracking and the use of overlapping IPv4
address ranges at a Gateway, this Gateway needs to support explicit
tracking based on identifiers other than the source IP-address of
IGMP messages. The Gateway functions as IPv4-Multicast first hop
router for the access devices. The Gateway is a multicast
replication point for multicast flows towards receivers on or
attached to the access devices. IPv4-Multicast traffic will be
forwarded according to the group/source-specific forwarding states.
If there are multiple receivers within the scope of the Gateway, its
still a single flow which the Gateway receives. IPv4-Multicast
forwarding at the Gateway is also not impacted in case IGMP-proxies
exist between the access devices and the Gateway. This can be the
case in broadband architectures (see [TR101]) as well as in mobile
architectures (e.g., with PMIP, the MAG acts as MLD proxy, see
[I-D.ietf-multimob-pmipv6-base-solution]).

4. Acknowledgements

The authors would like to acknowledge their discussions on this topic
with Wojciech Dec and Sri Gundavelli.

5. IANA Considerations

This document includes no request to IANA.

6. Security Considerations

   This draft does not introduce additional messages or novel protocol
   operations. Consequently, no new threats are introduced by this
   document in addition to those identified as security concerns for IP-
   Multicast deployments.

7. References

7.1. Normative References

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7.2. Informative References

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