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Outsourcing Home Network Authoritative Naming Service
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Abstract

CPEs are designed to provide IP connectivity to home networks. Most CPEs assign IP addresses to the nodes of the home network which makes it a good candidate for hosting the naming service. With IPv6, the naming service makes nodes reachable from the home network as well as from the Internet.

However, CPEs have not been designed to host such a naming service exposed on the Internet. This may expose the CPEs to resource exhaustion which would make the home network unreachable, and most probably would also affect the home network inner communications.

In addition, DNSSEC management and configuration may not be well understood or mastered by regular end users. Misconfiguration may also results in naming service disruption, thus these end users may prefer to rely on third party naming providers.

This document describes a homenet naming architecture where the CPEs manage the DNS zone associates to its home network, and outsources the naming service and eventually the DNSSEC management on the Internet to a third party designated as the Public Authoritative Servers.

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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1. Requirements notation

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 [RFC2119].

2. Introduction

IPv6 provides global end to end IP reachability. To access services hosted in the home network with IPv6 addresses, end users prefer to use names instead of long and complex IPv6 addresses.

CPEs are already providing IPv6 connectivity to the home network and generally provide IPv6 addresses or prefixes to the nodes of the home network. This makes the CPEs a good candidate to manage binding between names and IP addresses of the nodes. In addition, [I-D.ietf-homenet-arch] recommends that home networks be resilient to connectivity disruption from the ISP. This requires that a dedicate device inside the home network manage bindings between names and IP addresses of the nodes and builds the DNS Homenet Zone. All this makes the CPE the natural candidate for setting the DNS(SEC) zone file of the home network.

CPEs are usually low powered devices designed for the home network, but not for heavy traffic. As a result, hosting the an authoritative DNS service on the Internet may expose the home network to resource exhaustion, which may isolate the home network from the Internet and affect the services hosted by the CPEs, thus affecting the overall home network communications.

In order to avoid resource exhaustion, this document describes an architecture that outsources the authoritative naming service of the home network. More specifically, the DNS(SEC) Homenet Zone built by the CPE is outsourced to Public Authoritative Servers. These servers publish the corresponding DN(SEC) Public Zone on the Internet. Section 4.1 describes the architecture. In order to keep the DNS(SEC) Public Zone up-to-date Section 5 describes how the DNS(SEC) Homenet Zone and the DN(SEC) Public Zone can be synchronized. The proposed architecture aims at deploying DNSSEC and the DNS(SEC) Public Zone is expected to be signed with a secure delegation. The zone signing and secure delegation can be performed either by the CPE or by the Public Authoritative Servers. Section 6 discusses these two alternatives. Section 7 discusses the impact of multiple views and Section 8 discusses the case of the reverse zone.

3. Terminology

- Customer Premises Equipment: (CPE) is the router providing connectivity to the home network. It is configured and managed by the end user. In this document, the CPE MAY also hosts services such as DHCPv6. This device MAY be provided by the ISP.

- Registered Homenet Domain: is the Domain Name associated to the home network.

- DNS Homenet Zone: is the DNS zone associated to the home network. This zone is set by the CPE and essentially contains the bindings between names and IP addresses of the nodes of the home network. In this document, the CPE does neither perform any DNSSEC management operations such as zone signing nor provide an authoritative service for the zone. Both are delegated to the Public Authoritative Server. The CPE synchronizes the DNS Homenet Zone with the Public Authoritative Server via a hidden master / slave architecture. The Public Authoritative Server MAY use specific servers for the synchronization of the DNS Homenet Zone: the Public Authoritative Name Server Set as public available name servers for the Registered Homenet Domain.

- DNS Homenet Reverse Zone: The reverse zone file associated to the DNS Homenet Zone.

- Public Authoritative Server: performs DNSSEC management operations as well as provides the authoritative service for the zone. In this document, the Public Authoritative Server synchronizes the DNS Homenet Zone with the CPE via a hidden master / slave architecture. The Public Authoritative Server acts as a slave and MAY use specific servers called Public Authoritative Name Server Set. Once the Public Authoritative Server synchronizes the DNS Homenet Zone, it signs the zone and generates the DNSSEC Public Zone. Then the Public Authoritative Server hosts the zone as an authoritative server on the Public Authoritative Master(s).

- DNSSEC Public Zone: corresponds to the signed version of the DNS Homenet Zone. It is hosted by the Public Authoritative Server, which is authoritative for this zone, and is reachable on the Public Authoritative Master(s).

- Public Authoritative Master(s): are the visible name server hosting the DNSSEC Public Zone. End users’ resolutions for the

Homenet Domain are sent to this server, and this server is a master for the zone.

- Public Authoritative Name Server Set: is the server the CPE synchronizes the DNS Homenet Zone. It is configured as a slave and the CPE acts as master. The CPE sends information so the DNSSEC zone can be set and served.

- Reverse Public Authoritative Master(s): are the visible name server hosting the DNS Homenet Reverse Zone. End users' resolutions for the Homenet Domain are sent to this server, and this server is a master for the zone.

- Reverse Public Authoritative Name Server Set: is the server the CPE synchronizes the DNS Homenet Reverse Zone. It is configured as a slave and the CPE acts as master. The CPE sends information so the DNSSEC zone can be set and served.

4. Architecture Description

This section describes the architecture for outsourcing the authoritative naming service from the CPE to the Public Authoritative Master(s). Section 4.1 describes the architecture, Section 4.2 and Section 4.3 illustrate this architecture and shows how the DNS(SEC) Homenet Zone should be built by the CPE, as well as lists the necessary parameters the CPE needs to outsource the authoritative naming service. These two section are informational and non normative.

4.1. Architecture Overview

Figure 1 provides an overview of the architecture.

The home network is designated by the Registered Homenet Domain Name -- example.com in Figure 1. The CPE builds the DNS(SEC) Homenet Zone associated to the home network. The content of the DNS(SEC) Homenet Zone is out of the scope of this document. The CPE may host and involve multiple services like a web GUI, DHCP [RFC6644] or mDNS [RFC6762]. These services may coexist and may be used to populate the DNS Homenet Zone. This document assumes the DNS(SEC) Homenet Zone has been populated with domain names that are intended to be publicly published and that are publicly reachable. More specifically, names associated to services or devices that are not expected to be reachable from outside the home network or names bound to non globally reachable IP addresses MUST NOT be part of the DNS(SEC) Homenet Zone.

Once the DNS(SEC) Homenet Zone has been built, the CPE does not host the authoritative naming service for it, but instead outsources it to the Public Authoritative Servers. The Public Authoritative Servers take the DNS(SEC) Homenet as an input and publishes the DNS(SEC) Public Zone. In fact the DNS(SEC) Homenet Zone and the DNS(SEC) Public Zone have different names as they may be different. If the CPE does not sign the DNS Homenet Zone, for example, the Public Authoritative Servers may instead sign it on behalf of the CPE. Figure 1 provides a more detailed description of the Public Authoritative Servers, but overall, it is expected that the CPE provides the DNS(SEC) Homenet Zone, the DNS(SEC) Public Zone is derived from the DNS(SEC) Homenet Zone and published on the Internet.

As a result, DNS(SEC) queries from the DNS(SEC) Resolvers on the Internet are answered by the Public Authoritative Server and do not reach the CPE. Figure 1 illustrates the case of the resolution of node1.example.com.

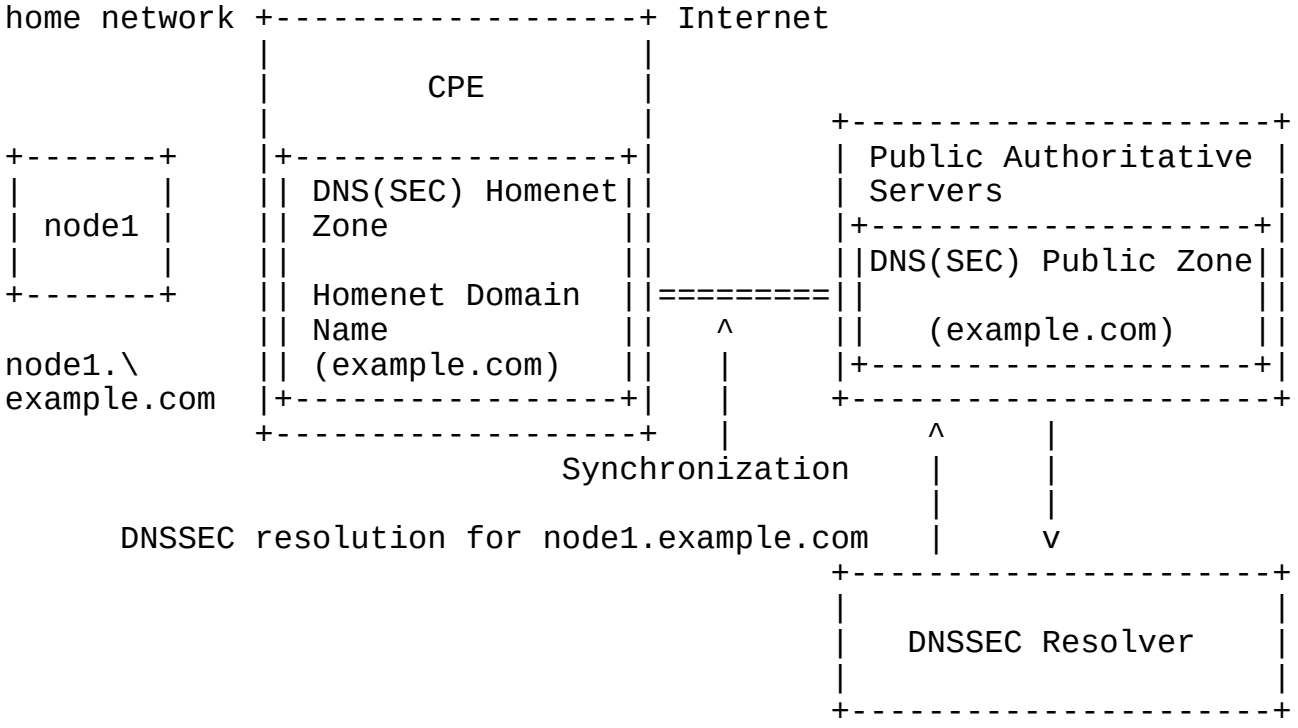

Figure 1: Homenet Naming Architecture Description

The Public Authoritative Servers are described in Figure 2. The Public Authoritative Name Server Set receives the DNS(SEC) Homenet Zone as an input. The received zone may be transformed to output the DNS(SEC) Public Zone. Various operations may be performed here, however the one this document considers here is zone signing when the

CPE outsources this operation. Implications of such policy are detailed in Section 6 and Section 7.

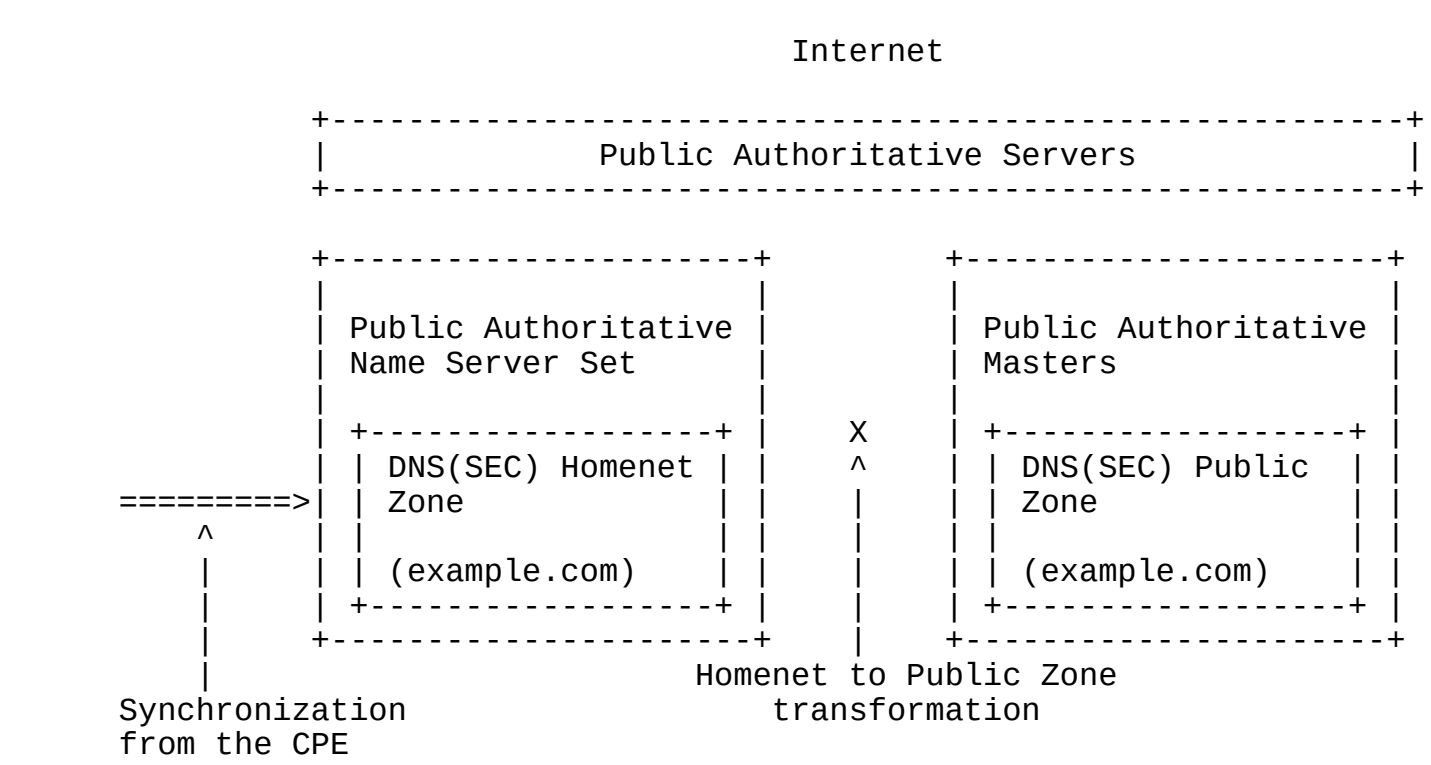

Figure 2: Public Authoritative Servers Description

4.2. Example: DNS(SEC) Homenet Zone

This section is not normative and intends to illustrate how the CPE builds the DNS(SEC) Homenet Zone.

As depicted in Figure 1 and Figure 2, the DNS(SEC) Public Zone is hosted on the Public Authoritative Masters, whereas the DNS(SEC) Homenet Zone is hosted on the CPE. Motivations for keeping these two zones identical are detailed in Section 7, and this section considers that the CPE builds the zone that will be effectively published on the Public Authoritative Masters. In other words "Homenet to Public Zone transformation" is the identity.

In that case, the DNS Homenet Zone should configure its Name Server RRset (NS) and Start of Authority (SOA) with the ones associated to the Public Authoritative Masters. This is illustrated in Figure 3. public.masters.example.net is the FQDN of the Public Authoritative Masters, and IP1, IP2, IP3, IP4 are the associated IP addresses. Then the CPE should add the different new nodes that enter the home network, remove those that should be removed and sign the DNS Homenet Zone.

```
$ORIGIN example.com
$TTL 1h

@  IN  SOA  public.masters.example.net
            hostmaster.example.com. (
      2013120710 ; serial number of this zone file
      1d         ; slave refresh
      2h         ; slave retry time in case of a problem
      4w         ; slave expiration time
      1h         ; maximum caching time in case of failed
                 ; lookups
      )

@   NS  public.authoritative.servers.example.net

public.masters.example.net   A @IP1
public.masters.example.net   A @IP2
public.masters.example.net   AAAA @IP3
public.masters.example.net   AAAA @IP4
```

Figure 3: DNS Homenet Zone

The SOA RRset is defined in [RFC1033], [RFC1035]. This SOA is specific as it is used for the synchronization between the Hidden Master and the Public Authoritative Name Server Set and published on the DNS Public Authoritative Master.

- MNAME: indicates the primary master. In our case the zone is published on the Public Authoritative Master, and its name MUST be mentioned. If multiple Public Authoritative Masters are involved, one of them MUST be chosen. More specifically, the CPE MUST NOT place the name of the Hidden Master.

- RNAME: indicates the email address to reach the administrator. [RFC2142] recommends to use hostmaster@domain and replacing the '@' sign by '.'.

- REFRESH and RETRY: indicate respectively in seconds how often slaves need to check the master and the time between two refresh when a refresh has failed. Default value indicated by [RFC1033] are 3600 (1 hour) for refresh and 600 (10 minutes) for retry. This value MAY be long for highly dynamic content. However, Public Authoritative Masters and the CPE are expected to implement NOTIFY [RFC1996]. Then short values MAY increase the bandwidth usage for slaves hosting large number of zones. As a result, default values looks fine.

EXPIRE: is the upper limit data SHOULD be kept in absence of refresh. Default value indicated by [RFC1033] is 3600000 about 42 days. In home network architectures, the CPE provides both the DNS synchronization and the access to the home network. This device MAY be plug / unplugged by the end user without notification, thus we recommend large period.

MINIMUM: indicates the minimum TTL. Default value indicated by [RFC1033] is 86400 (1 day). For home network, this value MAY be reduced, and 3600 (1hour) seems more appropriated.

4.3. Example: CPE necessary parameters for outsourcing

This section specifies the various parameters required by the CPE to configure the naming architecture of this document. This section is informational, and is intended to clarify the information handled by the CPE and the various settings to be done.

Public Authoritative Name Server Set may be defined with the following parameters. These parameters are necessary to establish a secure channel between the CPE and the Public Authoritative Name Server Set:

- Public Authoritative Name Server Set: The associated FQDNs or IP addresses of the Public Authoritative Server. IP addresses are optional and the FQDN is sufficient. To secure the binding name and IP addresses, a DNSSEC exchange is required. Otherwise, the IP addresses should be entered manually.

- Authentication Method: How the CPE authenticates itself to the Public Server. This MAY depend on the implementation but we should consider at least IPsec, DTLS and TSIG

- Authentication data: Associated Data. PSK only requires a single argument. If other authentication mechanisms based on certificates are used, then, files for the CPE private keys, certificates and certification authority should be specified.

- Public Authoritative Master(s): The FQDN or IP addresses of the Public Authoritative Master. It MAY correspond to the data that will be set in the NS RRsets and SOA of the DNS Homenet Zone. IP addresses are optional and the FQDN is sufficient. To secure the binding name and IP addresses, a DNSSEC exchange is required. Otherwise, the IP addresses should be entered manually.

- Registered Homenet Domain: The domain name the Public Authoritative is configured for DNS slave, DNSSEC zone signing and DNSSEC zone hosting.

Setting the DNS(SEC) Homenet Zone requires the following information.

- Registered Homenet Domain: The Domain Name of the zone. Multiple Registered Homenet Domain may be provided. This will generate the creation of multiple DNS Homenet Zones.

- Public Authoritative Server: The Public Authoritative Servers associated to the Registered Homenet Domain. Multiple Public Authoritative Server may be provided.

5. Synchronization between CPE and Public Authoritative Servers

The DNS(SEC) Homenet Reverse Zone and the DNS Homenet Zone can be updated either with DNS update [RFC2136] or using a master / slave synchronization. The master / slave mechanism is preferred as it better scales and avoids DoS attacks: First the master notifies the slave the zone must be updated, and leaves the slave to proceed to the update when possible. Then, the NOTIFY message sent by the master is a small packet that is less likely to load the slave. At last, the AXFR query performed by the slave is a small packet sent over TCP (section 4.2 [RFC5936]) which makes unlikely the slave to perform reflection attacks with a forged NOTIFY. On the other hand, DNS updates can use UDP, packets require more processing then a NOTIFY, and they do not provide the server the opportunity to post-pone the update.

This document recommends the use of a master / slave mechanism instead of the use of nsupdates. This section details the master / slave mechanism.

5.1. Synchronization with a Hidden Master

Uploading and dynamically updating the zone file on the Public Authoritative Name Server Set can be seen as zone provisioning between the CPE (Hidden Master) and the Public Authoritative Name Server Set (Slave Server). This can be handled either in band or out of band.

The Public Authoritative Name Server Set is configured as a slave for the Homenet Domain Name. This slave configuration has been previously agreed between the end user and the provider of the Public Authoritative Servers. In order to set the master/ slave architecture, the CPE acts as a Hidden Master Server, which is a regular Authoritative DNS(SEC) Server listening on the WAN interface.

The Hidden Master Server is expected to accept SOA [RFC1033], AXFR [RFC1034], and IXFR [RFC1995] queries from its configured slave DNS servers. The Hidden Master Server SHOULD send NOTIFY messages [RFC1996] in order to update Public DNS server zones as updates occur. Because, DNS Homenet Zones are likely to be small, CPE MUST implement AXFR and SHOULD implement IXFR.

Hidden Master Server differs from a regular authoritative server for the home network by:

- Interface Binding: the Hidden Master Server listens on the WAN Interface, whereas a regular authoritative server for the home network would listen on the home network interface.

- Limited exchanges: the purpose of the Hidden Master Server is to synchronizes with the Public Authoritative Name Server Set, not to serve zone. As a result, exchanges are performed with specific nodes (the Public Authoritative Servers). Then exchange types are limited. The only legitimate exchanges are: NOTIFY initiated by the Hidden Master and IXFR or AXFR exchanges initiated by the Public Authoritative Name Server Set. On the other hand regular authoritative servers would respond any hosts on the home network, and any DNS(SEC) query would be considered. The CPE SHOULD filter IXFR/AXFR traffic and drop traffic not initiated by the Public Authoritative Server. The CPE MUST listen for DNS on TCP and UDP and at least allow SOA lookups to the DNS Homenet Zone.

5.2. Securing Synchronization

Exchange between the Public Servers and the CPE MUST be secured, at least for integrity protection and for authentication. This is the case whatever mechanism is used between the CPE and the Public Authoritative Name Server Set.

TSIG [RFC2845] or SIG(0) [RFC2931] can be used to secure the DNS communications between the CPE and the Public DNS(SEC) Servers. TSIG uses a symmetric key which can be managed by TKEY [RFC2930]. Management of the key involved in SIG(0) is performed through zone updates. How to roll the keys with SIG(0) is out-of-scope of this document. The advantage of these mechanisms is that they are only associated with the DNS application. Not relying on shared libraries ease testing and integration. On the other hand, using TSIG, TKEY or SIG(0) requires that these mechanisms to be implemented on the DNS(SEC) Server’s implementation running on the CPE, which adds codes. Another disadvantage is that TKEY does not provides authentication mechanism.

Protocols like TLS [RFC5246] / DTLS [RFC6347] can be used to secure the transactions between the Public Authoritative Servers and the CPE. The advantage of TLS/DTLS is that this technology is widely deployed, and most of the boxes already embeds a TLS/DTLS libraries, eventually taking advantage of hardware acceleration. Then TLS/DTLS provides authentication facilities and can use certificates to authenticate the Public Authoritative Server and the CPE. On the other hand, using TLS/DTLS requires to integrate DNS exchange over TLS/DTLS, as well as a new service port. This is why we do not recommend this option.

IPsec [RFC4301] IKEv2 [RFC5996] can also be used to secure the transactions between the CPE and the Public Authoritative Servers. Similarly to TLS/DTLS, most CPE already embeds a IPsec stack, and IKEv2 provides multiple authentications possibilities with its EAP framework. In addition, IPsec can be used to protect the DNS exchanges between the CPE and the Public Authoritative Servers without any modifications of the DNS Servers or client. DNS integration over IPsec only requires an additional security policy in the Security Policy Database. One disadvantage of IPsec is that it hardly goes through NATs and firewalls. However, in our case, the CPE is connected to the Internet, and IPsec communication between the CPE and Public Authoritative Server SHOULD NOT be impacted by middle boxes.

As mentioned above, TSIG, IPsec and TLS/DTLS may be used to secure transactions between the CPE and the Public Authentication Servers. The CPE and Public Authoritative Server SHOULD implement TSIG and IPsec.

How the PSK can be used by any of the TSIG, TLS/DTLS or IPsec protocols. Authentication based on certificates implies a mutual authentication and thus requires the CPE to manage a private key, a public key or certificates as well as Certificate Authorities. This adds complexity to the configuration especially on the CPE side. For this reason, we recommend that CPE MAY use PSK or certificate base authentication and that Public Authentication Servers MUST support PSK and certificate based authentication.

5.3. CPE Security Policies

This section details security policies related to the Hidden Master / Slave synchronization.

The Hidden Master, as described in this document SHOULD drop any queries from the home network. This can be performed with port binding and/or firewall rules.

The Hidden Master SHOULD drop on the WAN interface any DNS queries that is not issued from the Public Authoritative Server Name Server Set.

The Hidden Master SHOULD drop any outgoing packets other than DNS NOTIFY query, SOA response, IXFR response or AXFR responses.

The Hidden Master SHOULD drop any incoming packets other than DNS NOTIFY response, SOA query, IXFR query or AXFR query.

The Hidden Master SHOULD drop any non protected IXFR or AXFR exchange. This depends how the synchronization is secured.

6. DNSSEC compliant Homenet Architecture

[I-D.ietf-homenet-arch] in Section 3.7.3 recommends DNSSEC to be deployed on the both the authoritative server and the resolver. The resolver side is out of scope of this document, and only the authoritative part is considered.

Deploying DNSSEC requires signing the zone and configuring a secure delegation. As described in Section 4.1, signing can be performed by the CPE or by the Public Authoritative Servers. Section 6.1 details the implications of these two alternatives. Similarly, the secure delegation can be performed by the CPE or by the Public Authoritative Servers. Section 6.2 discusses these two alternatives.

6.1. Zone Signing

This section discusses the pros and cons when zone signing is performed by the CPE or by the Public Authoritative Servers. It is recommended to sign the zone by the CPE unless there is a strong argument against it, like a CPE that is not able to sign the zone. In that case zone signing may be performed by the Public Authoritative Servers on behalf of the CPE.

Reasons for signing the zone by the CPE are:

- 1: Keeping the Homenet Zone and the Public Zone equals. This aspect is discussed in detail in Section 7. More specifically, if the CPE signs the DNS Homenet Zone, then, the CPE has the ability to host the authoritative naming service of the homenet for DNSSEC queries coming from within the network. As a result, a query will be resolved the same way whether it is sent from the home network or from the Internet. On the other hand, if the CPE does not sign the DNS Homenet Zone, either it acts as an authoritative server for the home network or not. If the CPE is an authoritative server for queries initiated

from within the home network, then nodes connected to both networks-- the home network and the Internet -- do not have a unique resolution. Devices that may be impacted are mobile phones with Radio Access Network interfaces and WLAN interfaces. Alternatively if the CPE does not act as an authoritative server, it goes against the principles connectivity disruption independence exposed in [I-D.ietf-homenet-arch] section 4.4.1 and 3.7.5. In case of connectivity disruption, naming resolution for nodes inside the home network for nodes in the home network are not possible.

- 2: Privacy and Integrity of the DNS Zone are better guaranteed. When the Zone is signed by the CPE, it makes modification of the DNS data -- for example for flow redirection -- not possible. As a result, signing the Homenet Zone by the CPE provides better protection for the end user privacy.

Reasons for signing the zone by the Public Authoritative Servers are:

- 1: The CPE is not able to sign the zone, most likely because its firmware does not make it possible. However the reason is expected to be less and less valid over time.

- 2: Outsourcing DNSSEC management operations. Management operations involve key-roll over which can be done automatically by the CPE and transparently for the end user. As result avoiding DNSSEC management is mostly motivated by bad software implementations.

- 3: Reducing the impact of CPE replacement on the Public Zone. Unless the CPE private keys are backuped, CPE replacement results in a emergency key roll over. This can be mitigated also by using relatively small TTLs.

- 4: Reducing configuration impacts on the end user. Unless there are some zero configuration mechanisms to provide credentials between the new CPE and the Public Authoritative Name Server Sets. Authentications to Public Authoritative Name Server Set should be re-configured. As CPE replacement is not expected to happen regularly, end users may not be at ease with such configuration settings. However, mechanisms as described in [I-D.mglt-homenet-naming-architecture-dhc-options] use DHCP Options to outsource the configuration and avoid this issue.

- 5: Public Authoritative Servers are more likely to handle securely private keys than the CPE. However, having all private information at one place may also balance that risk.

6.2. Secure Delegation

The secure delegation is set if the DS RRset is properly set in the parent zone. Secure delegation can be performed by the CPE or the Public Authoritative Servers.

The DS RRset can be updated manually by the CPE or the Public Authoritative Servers. This can be used then with nsupdate for example bu requires the CPE or the Public Authoritative Server to be authenticated by the Parent Zone Server. Such a trust channel between the CPE and the Parent Zone server may be hard to maintain, and thus may be easier to establish with the Public Authoritative Server. On the other hand, [I-D.ietf-dnsop-delegation-trust-maintainance] may mitigate such issues.

7. Handling Different Views

The issue raised by handling different views of the DNS Homenet Zone or a DNS Homenet Zone that differs from the Public Zone is that a given DNS query may lead to different responses. The responses may be different values for the queried RRsets or different RCODE or different RRsets types in the responses for DNS/DNSSEC responses.

The document does not recommend the CPE manages different views, since devices may be connected to different networks at the same time or may flip / flop from one network to the other.

8. Reverse Zone

Most of the description considered the DNS Homenet Zone as the non-Reverse Zone. This section is focused on the Reverse Zone.

First, all considerations for the DNS Homenet Zone apply to the Reverse Homenet Zone. The main difference between the Reverse DNS Homenet Zone and the DNS Homenet Zone is that the parent zone of the Reverse Homenet Zone is most likely managed by the ISP. As the ISP also provides the IP prefix to the CPE, it may be able to authenticate the CPE. If the Reverse Public Authoritative Name Server Set is managed by the ISP, credentials to authenticate the CPE for the zone synchronization may be set automatically and transparently to the end user. [I-D.mglt-homenet-naming-architecture-dhc-options] describes how automatic configuration may be performed.

9. Security Considerations

The Homenet Naming Architecture described in this document solves exposing the CPE's DNS service as a DoS attack vector.

9.1. Names are less secure than IP addresses

This document describes how an End User can make his services and devices from his home network reachable on the Internet with Names rather than IP addresses. This exposes the home network to attackers since names are expected to provide less randomness than IP addresses. The naming delegation protects the End User's privacy by not providing the complete zone of the home network to the ISP. However, using the DNS with names for the home network exposes the home network and its components to dictionary attacks. In fact, with IP addresses, the Interface Identifier is 64 bit length leading to 2^64 possibilities for a given subnetwork. This is not to mention that the subnet prefix is also of 64 bit length, thus providing another 2^64 possibilities. On the other hand, names used either for the home network domain or for the devices present less randomness (livebox, router, printer, nicolas, jennifer, ...) and thus exposes the devices to dictionary attacks.

9.2. Names are less volatile than IP addresses

IP addresses may be used to locate a device, a host or a Service. However, home networks are not expected to be assigned the same Prefix over time. As a result observing IP addresses provides some ephemeral information about who is accessing the service. On the other hand, Names are not expected to be as volatile as IP addresses. As a result, logging Names, over time, may be more valuable that logging IP addresses, especially to profile End User's characteristics.

PTR provides a way to bind an IP address to a Name. In that sense responding to PTR DNS queries may affect the End User's Privacy. For that reason we recommend that End Users may choose to respond or not to PTR DNS queries and may return a NXDOMAIN response.

10. IANA Considerations

This document has no actions for IANA.

11. Acknowledgment

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12. References

12.1. Normative References

[RFC1034] Mockapetris, P., "Domain names - concepts and facilities", STD 13, RFC 1034, November 1987.

[RFC1035] Mockapetris, P., "Domain names - implementation and specification", STD 13, RFC 1035, November 1987.

[RFC1995] Ohta, M., "Incremental Zone Transfer in DNS", RFC 1995, August 1996.

[RFC1996] Vixie, P., "A Mechanism for Prompt Notification of Zone Changes (DNS NOTIFY)", RFC 1996, August 1996.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC2136] Vixie, P., Thomson, S., Rekhter, Y., and J. Bound, "Dynamic Updates in the Domain Name System (DNS UPDATE)", RFC 2136, April 1997.

[RFC2142] Crocker, D., "MAILBOX NAMES FOR COMMON SERVICES, ROLES AND FUNCTIONS", RFC 2142, May 1997.

[RFC2845] Vixie, P., Gudmundsson, O., Eastlake, D., and B. Wellington, "Secret Key Transaction Authentication for DNS (TSIG)", RFC 2845, May 2000.

[RFC2930] Eastlake, D., "Secret Key Establishment for DNS (TKEY RR)", RFC 2930, September 2000.

[RFC2931] Eastlake, D., "DNS Request and Transaction Signatures (SIG(0)s)", RFC 2931, September 2000.

[RFC4301] Kent, S. and K. Seo, "Security Architecture for the Internet Protocol", RFC 4301, December 2005.

[RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", RFC 5246, August 2008.

[RFC5936] Lewis, E. and A. Hoenes, "DNS Zone Transfer Protocol (AXFR)", RFC 5936, June 2010.

[RFC5996] Kaufman, C., Hoffman, P., Nir, Y., and P. Eronen, "Internet Key Exchange Protocol Version 2 (IKEv2)", RFC 5996, September 2010.

[RFC6347] Rescorla, E. and N. Modadugu, "Datagram Transport Layer Security Version 1.2", RFC 6347, January 2012.

[RFC6644] Evans, D., Droms, R., and S. Jiang, "Rebind Capability in DHCPv6 Reconfigure Messages", RFC 6644, July 2012.

[RFC6762] Cheshire, S. and M. Krochmal, "Multicast DNS", RFC 6762, February 2013.

12.2. Informational References

[I-D.ietf-dnsop-delegation-trust-maintainance]
Kumari, W., Gudmundsson, O., and G. Barwood, "Automating DNSSEC Delegation Trust Maintenance", draft-ietf-dnsop-delegation-trust-maintainance-14 (work in progress), June 2014.

[I-D.ietf-homenet-arch]
Chown, T., Arkko, J., Brandt, A., Troan, O., and J. Weil, "IPv6 Home Networking Architecture Principles", draft-ietf-homenet-arch-16 (work in progress), June 2014.

[I-D.mglt-homenet-naming-architecture-dhc-options]
Migault, D., Cloetens, W., Griffiths, C., and R. Weber, "DHCP Options for Homenet Naming Architecture", draft-mglt-homenet-naming-architecture-dhc-options-02 (work in progress), July 2014.

[RFC1033] Lottor, M., "Domain administrators operations guide", RFC 1033, November 1987.

Appendix A. Document Change Log

[RFC Editor: This section is to be removed before publication]

-04:

*Clarifications on zone signing

*Rewording

*Adding section on different views

*architecture clarifications

-03:

*Simon’s comments taken into consideration

*Adding SOA, PTR considerations

*Removing DNSSEC performance paragraphs on low power devices

*Adding SIG(0) as a mechanism for authenticating the servers

*Goals clarification: the architecture described in the document 1) does not describe new protocols, and 2) can be adapted to specific cases for advance users.

-02:

*remove interfaces: "Public Authoritative Server Naming Interface" is replaced by "Public Authoritative Master(s)". "Public Authoritative Server Management Interface" is replaced by "Public Authoritative Name Server Set".

-01.3:

*remove the authoritative / resolver services of the CPE. Implementation dependent

*remove interactions with mdns and dhcp. Implementation dependent.

*remove considerations on low powered devices

*remove position toward homenet arch

*remove problem statement section

-01.2:

* add a CPE description to show that the architecture can fit CPEs

* specification of the architecture for very low powered devices.

* integrate mDNS and DHCP interactions with the Homenet Naming Architecture.

* Restructuring the draft. 1) We start from the homenet-arch draft to derive a Naming Architecture, then 2) we show why CPE need mechanisms that do not expose them to the Internet, 3) we describe the mechanisms.

* I remove the terminology and expose it in the figures A and B.

* remove the Front End Homenet Naming Architecture to Homenet Naming

-01:

* Added C. Griffiths as co-author.

* Updated section 5.4 and other sections of draft to update section on Hidden Master / Slave functions with CPE as Hidden Master/Homenet Server.

* For next version, address functions of MDNS within Homenet Lan and publishing details northbound via Hidden Master.

-00: First version published.

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