Network Working Group
Request for Comments: 5642
Category: Standards Track

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August 2009

Dynamic Hostname Exchange Mechanism for OSPF

Abstract

This document defines a new OSPF Router Information (RI) TLV that allows OSPF routers to flood their hostname-to-Router-ID mapping information across an OSPF network to provide a simple and dynamic mechanism for routers running OSPF to learn about symbolic hostnames, just like for routers running IS-IS. This mechanism is applicable to both OSPFv2 and OSPFv3.

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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1. Introduction

OSPF uses a 32-bit Router ID to uniquely represent and identify a node in the network. For management and operational reasons, network operators need to check the status of OSPF adjacencies, entries in the routing table, and the content of the OSPF link state database. When looking at diagnostic information, numerical representations of Router IDs (e.g., dotted-decimal or hexadecimal representations) are less clear to humans than symbolic names.

One way to overcome this problem is to define a hostname-to-Router-ID mapping table on a router. This mapping can be used bidirectionally (e.g., to find symbolic names for Router IDs and to find Router IDs for symbolic names) or unidirectionally (e.g., to find symbolic hostnames for Router IDs). Thus, every router has to maintain a table with mappings between router names and Router IDs.

These tables need to contain all names and Router IDs of all routers in the network. If these mapping tables are built by static definitions, it can currently become a manual and tedious process in operational networks; modifying these static mapping entries when additions, deletions, or changes occur becomes a non-scalable process very prone to error.

This document analyzes possible solutions to this problem (see Section 2) and provides a way to populate tables by defining a new

OSPF Router Information TLV for OSPF, the Dynamic Hostname TLV (see Section 3). This mechanism is applicable to both OSPFv2 and OSPFv3.

1.1. Specification of Requirements

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. Possible Solutions

There are various approaches to providing a name-to-Router-ID mapping service.

One way to build this table of mappings is by static definitions. The problem with static definitions is that the network administrator needs to keep updating the mapping entries manually as the network changes; this approach does not scale as the network grows, since there needs to be an entry in the mapping table for each and every router in the network, on every router in the network. Thus, this approach greatly suffers from maintainability and scalability considerations.

Another approach is having a centralized location where the name-to-Router-ID mapping can be kept. The DNS could be used for this. A disadvantage with this centralized solution is that it is a single point of failure; and although enhanced availability of the central mapping service can be designed, it may not be able to resolve the hostname in the event of reachability or network problems, which can be particularly problematic in times of problem resolution. Also, the response time can be an issue with the centralized solution, which can be equally problematic. If the DNS is used as the centralized mapping table, a network operator may desire a different name mapping than the existing mapping in the DNS, or new routers may not yet be in the DNS.

Additionally, for OSPFv3 in native IPv6 deployments, the 32-bit Router ID value will not map to IPv4-addressed entities in the network, nor will it be DNS resolvable (see Section 4).

The third solution that we have defined in this document is to make use of the protocol itself to carry the name-to-Router-ID mapping in a TLV. Routers that understand this TLV can use it to create the symbolic name-to-Router-ID mapping, and routers that don’t understand it can simply ignore it. This specification provides these semantics and mapping mechanisms for OSPFv2 and OSPFv3, leveraging the OSPF Router Information (RI) Link State Advertisement (LSA) ([RFC4970]).

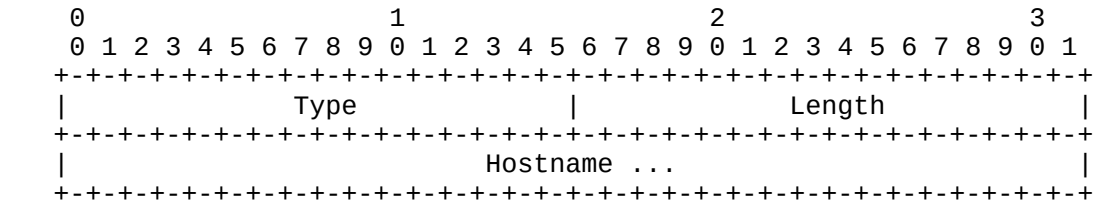
3. Implementation

This extension makes use of the Router Information (RI) Opaque LSA, defined in [RFC4970], for both OSPFv2 and OSPFv3, by defining a new OSPF Router Information (RI) TLV: the Dynamic Hostname TLV.

The Dynamic Hostname TLV (see Section 3.1) is OPTIONAL. Upon receipt of the TLV, a router may decide to ignore this TLV or to install the symbolic name and Router ID in its hostname mapping table.

3.1. Dynamic Hostname TLV

The format of the Dynamic Hostname TLV is as follows:



Type Dynamic Hostname TLV Type (7; see Section 6)

Length Total length of the hostname (Value field) in octets, not including the optional padding.

Value Hostname, a string of 1 to 255 octets, padded with zeroes to 4-octet alignment, encoded in the US-ASCII charset.

Routers that do not recognize the Dynamic Hostname TLV Type ignore the TLV (see [RFC4970]).

The Value field identifies the symbolic hostname of the router originating the LSA. This symbolic name can be the Fully Qualified Domain Name (FQDN) for the Router ID, it can be a subset of the FQDN, or it can be any string that operators want to use for the router. The use of FQDN or a subset of it is strongly recommended since it can be beneficial to correlate the OSPF dynamic hostname and the DNS hostname. The format of the DNS hostname is described in [RFC1035] and [RFC2181]. If there is no DNS hostname for the Router ID, if the Router ID does not map to an IPv4-addressed entity (e.g., see Section 4), or if an alternate OSPF dynamic hostname naming convention is desired, any string with significance in the OSPF routing domain can be used. The string is not null-terminated. The Router ID of this router is derived from the LSA header, in the Advertising Router field of the Router Information (RI) Opaque LSA.

The Value field is encoded in 7-bit ASCII. If a user-interface for configuring or displaying this field permits Unicode characters, that user-interface is responsible for applying the ToASCII and/or ToUnicode algorithm as described in [RFC3490] to achieve the correct format for transmission or display.

The Dynamic Hostname TLV is applicable to both OSPFv2 and OSPFv3.

3.1.1. Flooding Scope

The Dynamic Hostname TLV MAY be advertised within an area-local or autonomous system (AS)-scope Router Information (RI) LSA. But the Dynamic Hostname TLV SHOULD NOT be advertised into an area in more than one RI LSA, irrespective of the scope of the LSA.

In other words, if a router originates a Dynamic Hostname TLV with an IGP domain (AS) flooding scope, it SHOULD NOT send area-scoped Dynamic Hostname TLVs except into any attached Not-So-Stubby Area (NSSA) area(s). Similarly, if a router originates an area-scoped Dynamic Hostname TLV (other than NSSA area scoped), it SHOULD NOT send an AS-scoped Dynamic Hostname TLV. When the Dynamic Hostname TLV is advertised in more than one LSA (e.g., multiple area-scoped LSAs, or AS-scoped LSAs plus NSSA area-scope LSA(s)), the hostname SHOULD be the same.

If a router is advertising any AS-scope LSA (other than Dynamic Hostname TLV RI LSA), such router SHOULD advertise Dynamic Hostname TLV RI LSA in AS scope. Otherwise, it SHOULD advertise Dynamic Hostname TLV RI LSA in area scope. For example, an AS boundary router (ASBR) SHOULD send an AS-scope Dynamic Hostname TLV, whereas area boundary router (ABRs) and internal routers SHOULD send an area-scope Dynamic Hostname TLV.

The flooding scope is controlled by the Opaque LSA type in OSPFv2 and by the S1 and S2 bits in OSPFv3. For area scope, the Dynamic Hostname TLV MUST be carried within an OSPFv2 Type 10 RI LSA or an OSPFv3 RI LSA with the S1 bit set and the S2 bit clear. If the flooding scope is the entire routing domain (AS scope), the Dynamic Hostname TLV MUST be carried within an OSPFv2 Type 11 RI LSA or OSPFv3 RI LSA with the S1 bit clear and the S2 bit set.

3.1.2. Multiple OSPF Instances

When an OSPF Router Information (RI) LSA, including the Dynamic Hostname TLV, is advertised in multiple OSPF instances, the hostname SHOULD either be preserved or include a common base element. It may be useful for debugging or other purposes to assign separate instances different hostnames with a consistent set of suffixes or

prefixes that can be associated with a specific instance -- in particular, when an instance is used for a discrete address family or non-routing information.

4. IPv6 Considerations

Both OSPFv2 and OSPFv3 employ Router IDs with a common size of 32 bits. In IPv4, the Router ID values were typically derived automatically from an IPv4 address either configured on a loopback or physical interface defined on the local system or explicitly defined within the OSPF process configuration. With broader deployment of IPv6, it's quite likely that OSPF networks will exist that have no native IPv4-addressed interfaces. As a result, a 32-bit OSPF Router ID will need to be either explicitly specified or derived in some automatic manner that avoids collisions with other OSPF routers within the local routing domain.

Because this 32-bit value will not map to IPv4-addressed entities in the network, nor will it be DNS resolvable, it is considered extremely desirable from an operational perspective that some mechanism exist to map OSPF Router IDs to more easily interpreted values -- ideally, human-readable strings. This specification enables a mapping functionality that eases operational burdens that may otherwise be introduced with native deployment of IPv6.

5. Security Considerations

Since the hostname-to-Router-ID mapping relies on information provided by the routers themselves, a misconfigured or compromised router can inject false mapping information, including a duplicate hostname for different Router IDs. Thus, this information needs to be treated with suspicion when, for example, doing diagnostics about a suspected security incident.

There is potential confusion from name collisions if two routers use and advertise the same dynamic hostname. Name conflicts are not crucial, and therefore there is no generic conflict detection or resolution mechanism in the protocol. However, a router that detects that a received hostname is the same as the local one can issue a notification or a management alert.

The use of the FQDN as OSPF dynamic hostname potentially exposes geographic or other commercial information that can be deduced from the hostname when sent in the clear. OSPFv3 supports confidentiality via transport mode IPsec (see [RFC4552]). OSPFv2 could be operated over IPsec tunnels if confidentiality is required.

This document raises no other new security issues for OSPF. Security considerations for the base OSPF protocol are covered in [RFC2328] and [RFC5340]. The use of authentication for the OSPF routing protocols is encouraged.

6. IANA Considerations

IANA maintains the "OSPF Router Information (RI) TLVs" registry [IANA-RI]. An additional OSPF Router Information TLV Type is defined in Section 3. It has been assigned by IANA from the Standards Action allocation range [RFC4970].

Registry Name: OSPF Router Information (RI) TLVs

Type Value	Capabilities	Reference
7	OSPF Dynamic Hostname	This document

7. Acknowledgments

The authors of this document do not make any claims on the originality of the ideas described. This document adapts format and text from similar work done in IS-IS [RFC5301] (which obsoletes [RFC2763]); we would like to thank Naiming Shen and Henk Smit, authors of [RFC2763].

The authors would also like to thank Acee Lindem, Abhay Roy, Anton Smirnov, and Dave Ward for their valuable comments and suggestions.

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