Service Function Chaining
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NSH Context Header Allocation -- Broadband
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Abstract

This document provides a recommended allocation of context headers for a Network Service Header (NSH) within the broadband service provider network context. NSH is described in detail in [ietf-sfc-nsh]. This allocation is intended to support uses cases as defined in [ietf-sfc-use-case-mobility].

Requirements Language

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].

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1. Introduction

Service function chaining provides a mechanism for network traffic to be steered through multiple service functions in a sequence. Metadata can be useful to service functions. The Network Service Header (NSH) provides support for carrying shared metadata between service functions (and devices) either using 4 fixed-length 32-bit context headers or as optional TLVs as defined in [ietf-sfc-nsh]. NSH is then encapsulated within an outer header for transport.

This document provides a recommended default allocation scheme for the fixed-length context headers and for TLV types in the context of service chaining within fixed and mobile broadband service provider networks. Supporting use cases describing the need for a metadata header in these contexts are described in

[ietf-sfc-use-case-mobility]. This draft does not address control plane mechanisms.

2. Definition Of Terms

This document uses the terms as defined in [RFC7498] and [RFC7665].

3. Network Service Header (NSH) Context Headers

In Service Function Chaining, the Network Service Header is composed of a 4-byte base header (BH1), a 4-byte service path header (SH1) and a mandatory 16-byte context header in the case of MD Type 0x01 and optional TLVs in the case of MD Type 0x02 as described in [ietf-sfc-nsh].

The following Figure 1 shows the MD Type 0x01 mandatory context headers.

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Ver|O|U|    TTL    |   Length  |U|U|U|U|MD Type| Next Protocol | BH1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Service Path Identifier              | Service Index | SH1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                               |
+                                                               +
|                             Fixed                             |
+                         Context Header                        +
|                           (16 Bytes)                          |
+                                                               +
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: Network Service Header - MD Type 0x01

The following Figure 2 shows the MD Type 0x02 optional TLV header format.

```
     0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |Ver|O|U|    TTL    |   Length  |U|U|U|U|MD Type| Next Protocol | BH1
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |          Service Path Identifier              | Service Index | SH1
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                                                               |
    ~              Variable Length Context Headers  (opt.)          ~
    |                                                               |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: Network Service Header - MD Type 0x02

4. Recommended Context Allocation

The following header allocations provide information to support service function chaining in a service provider network, for example as described for mobility in [ietf-sfc-use-case-mobility].

The set of metadata headers can be delivered to service functions that can use the metadata within to enforce policy, communicate between service functions, provide subscriber information and other functionality. Several of the headers are typed allowing for different metadata to be provided to different service functions or even to the same service function but on different packets within a flow. Which metadata are sent to which service functions is decided in the SFC control plane and is thus out of the scope of this document.

4.1. MD Type 0x01 Allocation Specifics

The following Figure 3 provides a high-level description of the fields in the recommended allocation of the fixed sixteen byte context headers for a mobility context. Each four byte word in the sixteen byte context header is referred as CH1, CH2, CH3 and CH4, respectively.

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| R | Sub | Tag |                 Context ID                    | CH1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Sub/Endpoint ID                         ~ CH2
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                   Sub/Endpoint ID (cont.)                     | CH3
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Service Information                        | CH4
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 3: NSH Context Allocation

The intended use for each of the context header allocations is as follows:

R - Reserved.

Sub - Sub/Endpoint ID type field. These bits determine the type of the 64-bit Sub/Endpoint ID field that spans CH2 and CH3.

000 - If the Sub field is not set, then the 64-bit Sub/Endpoint ID field is an opaque field that can be used or ignored by service functions as determined by the control plane.

001 - The Sub/Endpoint ID field contains an IMSI [itu-e-164].

010 - The Sub/Endpoint ID field contains an MSISDN (8-15 digit) [itu-e-164].

011 - The Sub/Endpoint ID field contains a 64-bit identifier that can be used to group flows (e.g., in Machine-to-Machine, M2M).

100 - The Sub/Endpoint IP field contains a wireline subcriber ID in CH2, and CH3 contains the home identifier.

101-111 - Reserved.

Tag - The Tag field indicates the type of the Service Information field in CH4. Some types for this field are specified by the Tag field as follows:

000 - If the Tag field is not set, then the Service Information field in CH4 is an opaque field that can be used or ignored by service functions as determined by the control plane.

001 - The Service Information field in CH4 contains information related to the Access Network (AN) for the subscriber. This is

shown in Figure 4 for a 3GPP Radio Access Network (RAN). Note that these values should correspond to those that can be obtained for the flow from the corresponding 3GPP PCRF (Policy and Charging Rules Function) component using Diameter as described in [TS.29.230].

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| CAN |    QoS/DSCP   | Con |          App Id         |  Rsvd   | CH4
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4: Service Information RAN Allocation

CAN - IP-CAN-Type for IP Connectivity Access Network (Diameter AVP code 1027).

QoS - QoS-Class-Identifier AVP (Diameter AVP code 1028) or Differentiated Services Code Point (DSCP) marking as described in [RFC2474].

Con - Access congestion level. An Access Congestion level 000 means an unknown/undefined congestion level. An Access Congestion level 001 means no congestion. For other values of Access Congestion level, a higher value indicates a higher level of congestion.

App Id - Application ID describing the flow type. Allocation of IDs is done in the control plane and is out of the scope of this document.

Rsvd - Reserved.

010-111 - Reserved.

Context ID - The Context ID field allows the Subscriber/Endpoint ID field to be scoped. For example, the Context ID field could contain the incoming VRF, VxLAN VNID, VLAN, or policy identifier within which the Subscriber/Endpoint ID field is defined.

Sub/Endpoint ID - 64-bit length Subscriber/Endpoint identifier (e.g., IMSI, MSISDN, or implementation-specific Endpoint ID) of the corresponding subscriber/machine/application for the flow.

Service Information - The Service Information field is a unique identifier that can carry metadata specific to the flow or subscriber identified in the Sub/Endpoint ID field.

4.2. MD Type 0x02 Allocation Specifics

The following Figure 5 provides a high-level description of the fields in the recommended allocation of the variable length headers for a mobility context.

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     TLV Class = 3GPP          |C|    Type     |R|R|R|   Len   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Data ...
+-+-+-+-+-+-+-+-+
```

Figure 5: TLV Allocation

The intended use of the header is for TLVs associated with 3GPP Radio Access Networks as described in [TS.29.230]. This TLV can be used by 3GPP to extend the metadata as per use cases. Having this TLV helps to carry more information that does not fit within the MD Type 0x01.

The Len field carries the total length. Type = 0x01 is reserved. If set to 0x01, the TLV carries the 4 context headers as defined in Section 4.1.

5. Context Allocation and Control Plane Considerations

This document describes an allocation scheme for both the mandatory context headers and optional TLV headers in the context of broadband service providers. This suggested allocation of headers should be considered as a guideline and may vary depending on the use case. The control plane aspects of specifying and distributing the allocation scheme among different service functions within the Service Function Chaining environment to guarantee consistent semantics for the metadata is beyond the scope of this document.

6. Security Considerations

The header allocation recommended by this document includes numbers that must be distributed consistently across a Service Function Chaining environment. Protocols for distributing these numbers securely are required in the control plane, but are out of scope of this document.

Furthermore, some of the metadata carried in the headers require secure methods to prevent spoofing or modification by service function elements that may themselves be exposed to subscriber traffic and thus might be compromised. This document does not address such security concerns.

7. IANA Considerations

This document requests IANA to assign a TLV class for 3GPP to be used for its use cases.

8. Acknowledgments

The authors would like to thank Jim Guichard for his assistance structuring the document.

9. References

9.1. Normative References

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