Abstract

This draft provides a programmable NSC metadata that could be carried by different transport types to create network service paths. The NSC metadata architecture and metadata format are defined in this document. In addition, the NSC metadata format negotiation mechanism between network controller node and network forwarding nodes is specified.

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Network services are widely deployed and essential in new data center network and cloud architecture, which requires more flexible network service deployment models. The network services provide many functions: such as NAT, Firework, and server load balancing.

This document provides a network service based forwarding by metadata passing information between the network forwarding nodes (NFN). The packet is handled in a network forwarding node (NFN), and the forwarding parameters for that packet is encapsulated as metadata format and then inserted into the packet to form a service forwarding path, then the packet is passed to next network forwarding node. This mechanism improves the forwarding efficiency and flexibility by using the information from the previous NFN. In addition, a procedure to negotiate the metadata format is provided in this document.

2. Terminology

Network Forwarding Node: NFN, is a programmable Router/Switch, or even a logical switch device.

Network Controller Node: NCN. It interacts with NFN. The NCN negotiates the NSC metadata format with the NFNs.

Network service chaining: NSC, a service chain defines the services path required.
Metadata: a register value that is used to pass information from one NFN to the other.

3. Network Service Chaining Metadata Component Structure

Figure 1 is the metadata NSC component architecture. Consider three NFNs in the NSC network, NFN A, NFN B and NFN C. NFN A and NFN B support the same metadata format, i.e. metadata 1. NFN B and NFN C support another metadata format i.e. metadata 2.

The edge network forwarding node (NFN A) receives the packets from the traditional networks, and inserts the metadata to the packet based on the metadata 1 format. The packets including metadata 1 are transferred from NFN A to NFN B via a tunnel protocol specified by metadata 1.

After receiving the packets from NFN A, NFN B parses the packets according to the definition of metadata 1. This metadata is transparent to any other NFNs between NFN A and NFN B as they cannot be aware of metadata 1.

Similarly, the packets including metadata 2 are transferred from NFN B to NFN C via a tunnel protocol specified by metadata 2.
4. Network Service Chaining Metadata Format

Metadata format is defined as Figure 2. The metadata contains the following fields:

Transport type: is the corresponding value for the transport link that metadata would be carried (e.g. Ethertype, protocol number, UDP destination port). Metadata could be carried by different transport links. If it is carried by Ethernet link, the metadata is encapsulated as the payload of Ethernet frame, and the transport type is an Ethernet type/Length value (e.g. 0xa811, TBD). If it is carried by IP network, the transport type is a protocol number. If it is carried in UDP message, the metadata is in the UDP PDU message, and the corresponding transport type is UDP destination port.

Reserved: is reserved for future use.

Format ID: represents ID of this metadata format. The format ID is unique to identify a metadata format. There are 256 types of metadata format for maximum.

Length: indicates the total length of the metadata.

Service attribute: represents the attribute of the service for the metadata. It could be a flow-id of the traffic, or dpi-id for the DPI service.

If the packets carrying metadata are transferred via Ethernet type, the Ethertype would be replaced as Oxxyyy (e.g. 0xa811), and the original Ethertype could be stored as one of the service attribute of the metadata. When the next NFN receives the packets, it decapsulates the packets and retrieves the original Ethertype according to the value carried in the metadata.
Figure 2 Metadata format

5. Network Service Chaining Metadata Generation

The NCN could request NFN to encapsulate the metadata or not. If the metadata needs to be encapsulated in the packet, the NCN would indicate the NFN how to generate and encapsulate the metadata. The NCN could send the metadata generation message to the NFN, including the transport type, generation parameters. For the source of the metadata content could be generated by the following methods:

- **FIX**: the value is determined by the NCN.
- **PACKET**: the value comes from the packet, and the field is specified by the NCN.
- **LOCAL**: the value is generated locally. For example, it is a 32bits random value, or 64bits time stamp.
- **METADATA**: the value comes from the metadata from the previous NFN.

6. Metadata Format Negotiation

Metadata is configured locally in a network forwarding node by CLI, SNMP. Each network forwarding node could support several metadata formats (metadata format list). The network forwarding node reports its metadata format list to the network controller node via a protocol, which could be the extension of the existing protocol, such as I2RS protocol ([I2RS]), or some other new protocol. When NCN computes the service path based on the service requirements, it sends the metadata format or rules to the NFNs corresponding to a specific service path, to indicate those NFN’s metadata encapsulation methods for their next NFNs.

7. Benefits of NSC Metadata

The network service chaining metadata can provides the following benefits:

(1) Providing service chaining path: The data plane forwarding parameters for a service could be added to service attribute fields of metadata. The service is usually classified, and formed the forwarding parameters, which are encapsulated as metadata format at the edge network forwarding node. The other NFNs supporting the same metadata format can use the forwarding parameters for service forwarding when receive the packets with that metadata encapsulation.
(2) Programmability and flexibility: the metadata format is negotiated among NFNs, and can be programmable through NCN. The NFN can support 256 types of metadata at most, which can satisfy the current service requirements. In addition, the metadata can be carried at multiple transport networks (e.g. Ethernet, IP, and UDP).

(3) Compatibility: the packet with metadata encapsulation is transparent to any other NFNs which do not support metadata format. This solution does not bring any compatibility issues for the current networks.

8. IANA Considerations

IANA is requested to allocate a protocol number (xx) if transport type is IP network, and a port number (xxxx) if UDP message.

8.1. Security Considerations

TBD

8.2. Acknowledgements

TBD

9. Normative References


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