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VXLAN GPE Extension for Packets Exchange Between Control and User Plane of vBNG

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Abstract

This document briefly describes the architecture of control plane and user plane separated vBNG and define the extension of VXLAN-GPE for PPPoE/IPoE dialup packets exchange between control plane and user plane.

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1. Introduction

For migration of vBNG, one way is separating the control plane(CP) and user plane(UP) of traditional BNG. CP is deployed in centrolized cloud DC and UP is fulfilled by high performance hardware device, e.g. router, switch, etc. VXLAN-GPE is used to transfer PPPoE/IPoE dialup packets between CP and UP. This document describes how to extend VXLAN-GPE to carry necessary information of access user in VXLAN packets.

2. Terminology and Abbreviations

BNG: Broadband Network Gateway. It is usually the layer 3 edge node of ISP's core network and provides users access control for broadband service. It's also known as BRAS(Broadband Remote Access Server) or BAS(Broadband Access Server).

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].

3. Requirement

The architecture of C/U separated BNG is shown as the following figure.

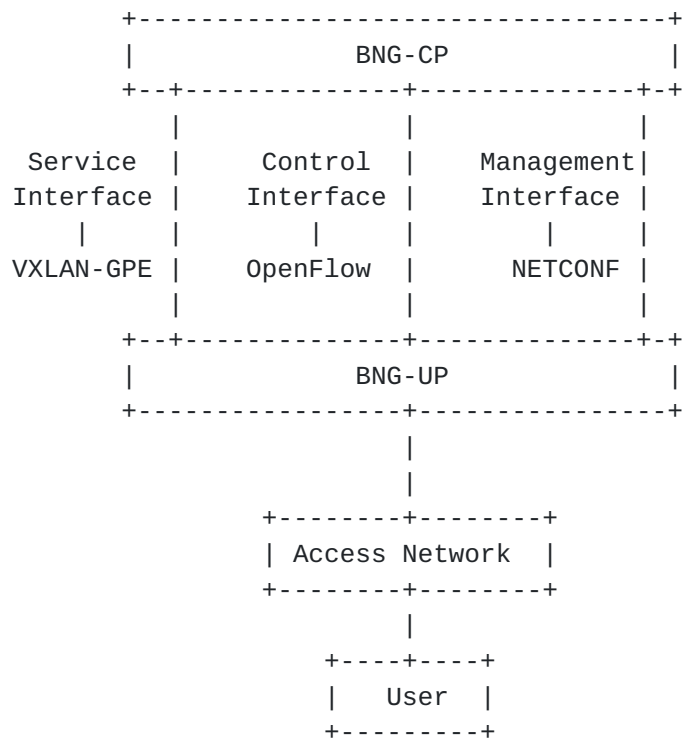

Figure 1: Architecture of C/U separated vBNG

In this architecture, CP is responsible for user access authentication and setting forwarding entries of UP if authentication is successful. UP need to relay PPPoE/IPoE dialup packets between users and CP and forward PPPoE/IPoE data packets to Internet based on the forwarding entries set by CP. CP should do some basic configurations on UP, e.g. user profile configuration.

There are three interfaces between CP and UP. Management interface is used by CP to carry out basic configurations of UP through NETCONF. Control interface is used for seting forwarding entries on UP through OpenFlow. Service interface is used to transmitting PPPoE/IPoE dialup packets between user plane and control plane. VXLAN-GPE is chosen for service interface since it's a relatively mature technology and can carry L2 packets through L3 network. For user access authentication, CP need to know which port of UP the user is connected to for the authentication of access location because a specfic user is only permitted to access on specific port/location. The necessary information include: node ID, slot ID, subcard ID, port ID and so on. The access port information should be carried in VXLAN packets encapsulated by UP. The next section describes how to extend VXLAN-GPE this requirement.

4. Mechanism

In order to extend VXLAN-GPE for carrying user access port information, a new next protocol value will be requested from IANA based on Generic Protocol Extension for VXLAN [I-D.ietf-nvo3-vxlan-gpe], see section IANA Considerations. The new next protocol is called vBNG service header.

4.1. vBNG service header

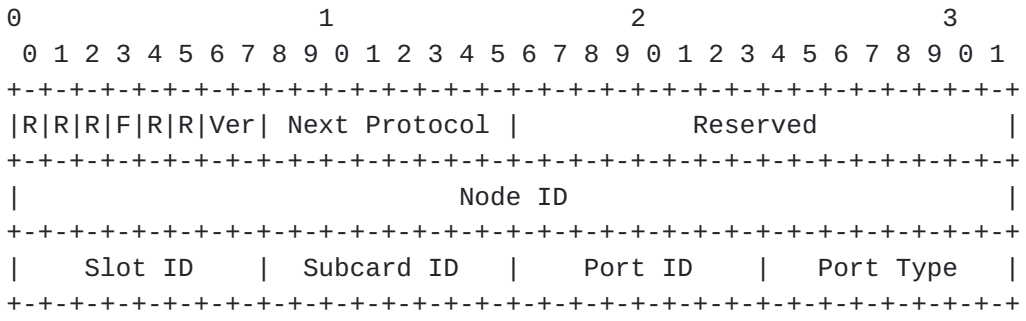

Figure 2: vBNG service header

Flag (8 bits): The first 8 bits are the flag field. "R" bits are reserved bits which MUST be set to zero and ignored.

F (1 bit): The F bit is set to indicated the inner packet following the vBNG service header SHOULD be forwarded based on the routing table by UP instead of forwarded to users. F bit is set only in the packets from CP to UP for some specific scenarios, e.g. DHCP relay, L2TP.

Ver (2 bits): Version of vBNG service header. In this document the version is 0.

Next protocol (8 bit): This field indicates the protocol immediatly following the vBNG service header. This doocument defines two next protocol value, 0x00 for PPPoE and 0x01 for IPoE.

Node ID (32 bit): This field indicates which UP node is processing the user access. It COULD be one of the UP's IP addresses which MUST be unique in all related UPs.

Slot ID (8 bit): This field indicates which slot of the indicated UP is processing the user access. If there is no different slots on the indicated UP this field MUST be set to 0x00.

Subcard ID (8 bit): This field indicates which subcard of the indicated slot is processing the user access. If there is no different subcards on the indicated slot this field MUST be set to 0x00.

Port ID (8 bit): This field indicates which port of the indicated subcard is processing the user access.

Port Type (8 bit): This field indicates the type of the user access port. This document defines the following types:

Port Type	Value
GE	0x01
10GE	0x02
40GE	0x03
100GE	0x04
LAG	0x05
Virtual Interface	0x06

Figure 3: User Access Port Types

4.2. Optional solution for vBNG service header

One optional solution is using ifIndex to indicate the port information.

The ifIndex of the interface MAY be included. This is the 32-bit ifIndex assigned to the interface by the device as specified by the Interfaces Group MIB [RFC2863].

The ifIndex can be utilized within a management domain to map to an actual interface, but it is also valuable in public applications. The ifIndex can be used as an opaque token to discern which interface of UP is processing the user access. And based on this index, the information binding with the interface of UP, such as the Slot ID, subcard ID, Port ID, etc, can be retrieved by the CP.

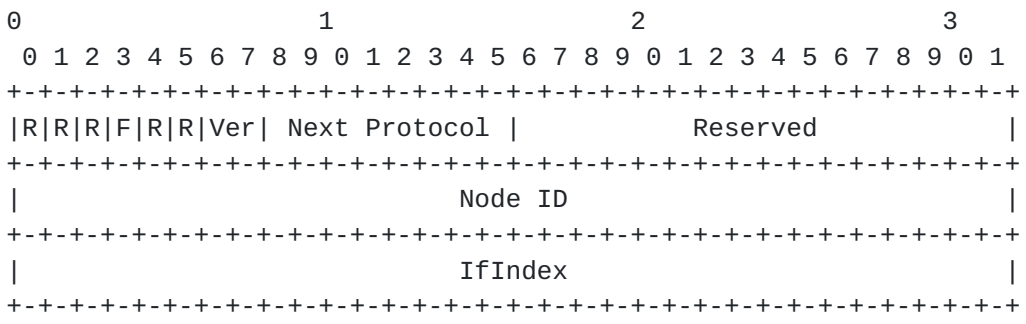

Figure 4: Optional vBNG service header

IfIndex (32 bit): This field indicates which interface of UP is processing the user access. And based on this index, the information which binding with the interface of UP, such as the Slot ID, subcard ID, Port ID, etc, can be retrieved by the CP.

Other fields have the same definition as the previous section.

4.3. Inner packets encapsulation and decapsulation

Following the vBNG service header it's the original PPPoE/IPoE dialup packet which SHOULD includes MAC, C-VLAN, S-VLAN, PPPoE/IPoE header, PPPoE/IPoE payload and so on. UP SHOULD NOT modify the original PPPoE/IPoE dialup packets when encapsulating them into VXLAN-GPE packets or decapsulating them from VXLAN-GPE packets.

4.4. User dialup process

When UP receives PPPoE/IPoE dialup packets from users, it encapsulates the original dialup packets in VXLAN-GPE with the user access port information and sends to CP. CP decapsulates VXLAN-GPE packets and processes PPPoE/IPoE related things, including AAA authentication and addresses allocation. CP encapsulates the PPPoE/IPoE response packets in VXLAN-GPE and sends to UP. UP decapsulates VXLAN-GPE packets and sends PPPoE/IPoE response packets to users. The following two diagrams show the PPPoE and IPoE process by UP and CP.

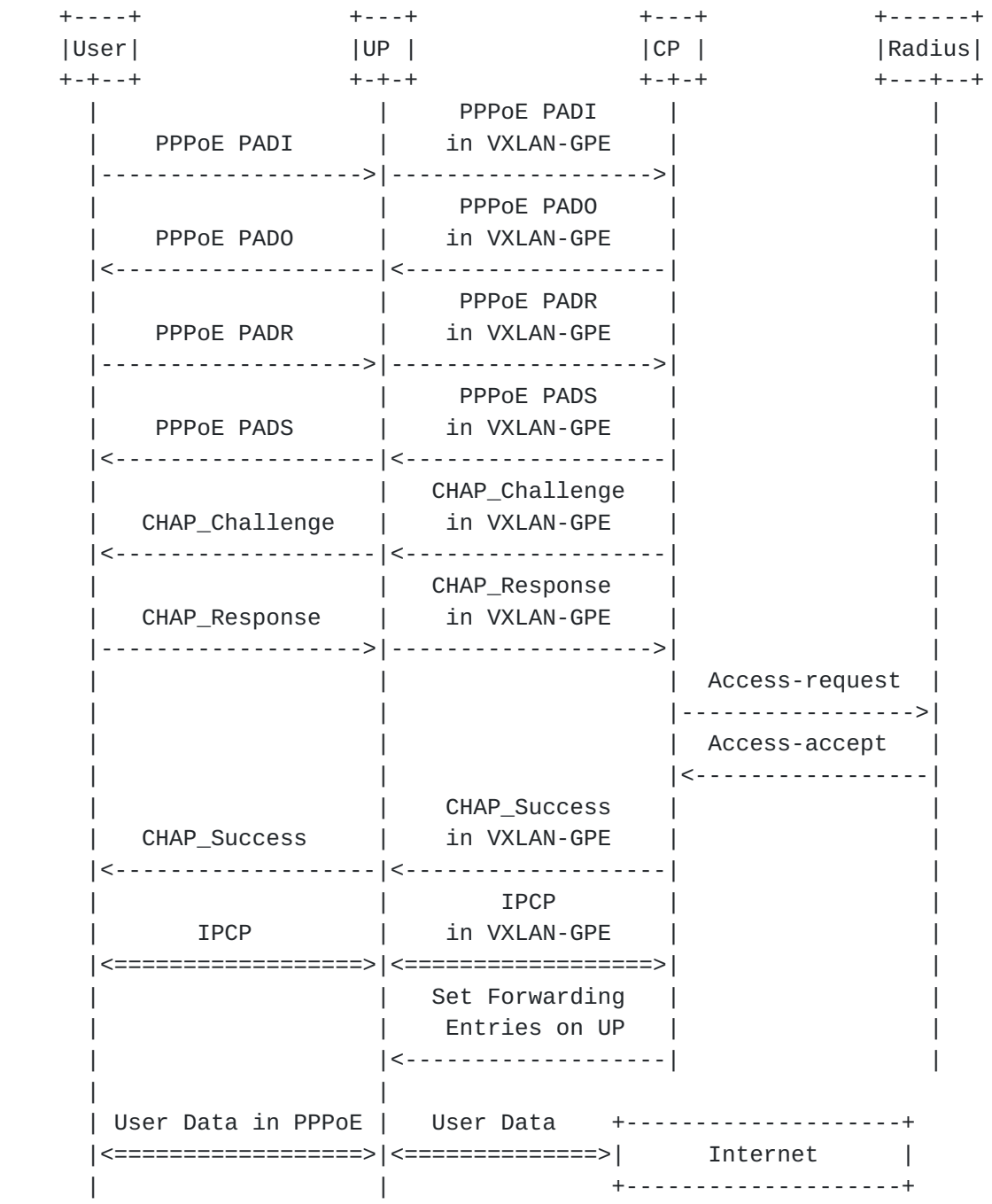

Figure 5: PPPoE Process

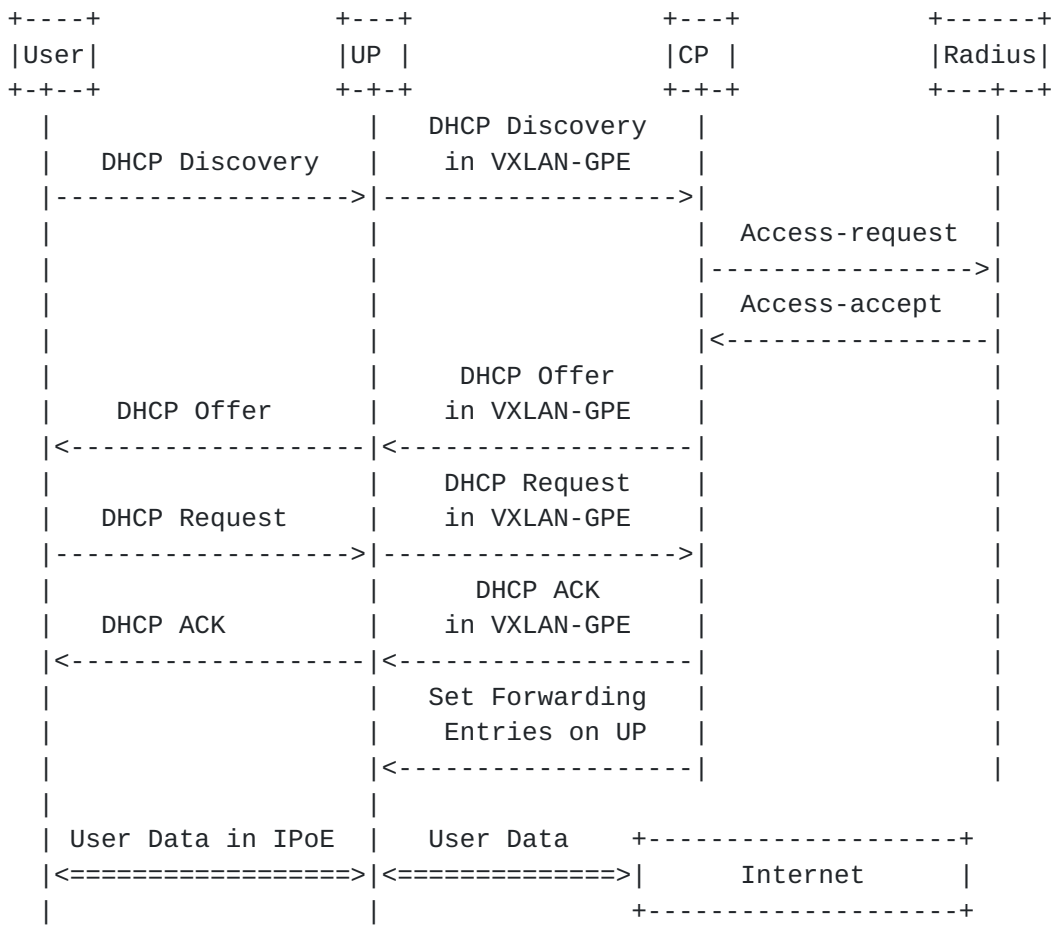

Figure 6: IPoE Process

5. Security Considerations

This document only defines new "Next Protocol" for C/U seperated vBNG. So, this document itself does not directly introduce more security issues. The same security considerations as Generic Protocol Extension for VXLAN [I-D.ietf-nvo3-vxlan-gpe].

6. IANA Considerations

IANA is requested to assign a new next protocol value in VXLAN-GPE header as the following:

Next Protocol	Description	Reference
TBD	vBNG service header	This Document

Figure 7: Requested new next protocol

7. Normative References

[I-D.ietf-nvo3-vxlan-gpe]
Maino, F., Kreeger, L., and U. Elzur, "Generic Protocol Extension for VXLAN", draft-ietf-nvo3-vxlan-gpe-04 (work in progress), April 2017.

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[RFC7348] Mahalingam, M., Dutt, D., Duda, K., Agarwal, P., Kreeger, L., Sridhar, T., Bursell, M., and C. Wright, "Virtual eXtensible Local Area Network (VXLAN): A Framework for Overlaying Virtualized Layer 2 Networks over Layer 3 Networks", RFC 7348, DOI 10.17487/RFC7348, August 2014, <https://www.rfc-editor.org/info/rfc7348>.

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