VXLAN Tunnel Gateway Example

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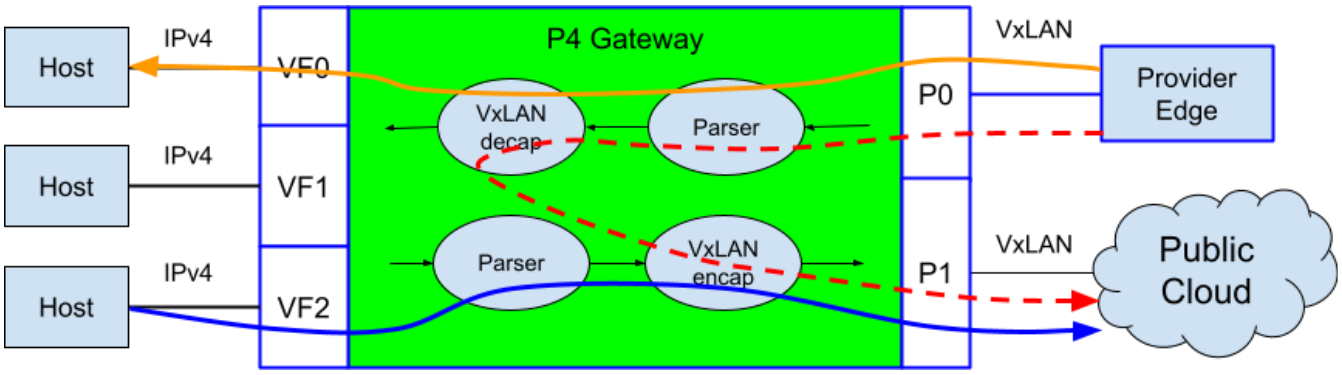
This example illustrates how to write a basic VXLAN tunnel gateway using the DOCA target architecture. A tunnel gateway allows programmatic control over how VXLAN traffic can be "stitched" packets across tenant domains. In this example, end point traffic destined to local bare metal hosts can be decapsulated and forwarded to a VF, while gateway traffic can be decapsulated, re-encapsulated and sent back to the wire. For example, this program can be easily extended to be a gateway connecting legacy NVGRE networks to a VXLAN-GPE network.



Sample Code

This example users the native parser and 2 tables, of size 32K each. The wire port is configured with P4 port ID 0. A single bit in the user metadata structure is used to keep the decapsulation state.

```
#include <doca_model.p4>
#include <doca_headers.p4>
#include <doca_externs.p4>
#include <doca_parser.p4>

/*
* Table sizes.
*/
const bit<32> DECAP_TABLE_SIZE = 32768;
const bit<32> ENCAP_TABLE_SIZE = 32768;

/* The directionality is based on network to host
 * The user will configure the P4 port IDs in the OVS configuration
 */
const bit<32> WIRE_PORT = 32w0;
```

```
struct metadata_t {
    bit<1> was_decapped;
}

struct headers_t {
    NV_FIXED_HEADERS
}

parser packet_parser(packet_in packet, out headers_t headers) {
    NV_FIXED_PARSER(packet, headers)
}
```

The encapsulation control has a single table, matching on IPv4 destination address. If an entry matches, the packet is VXLAN encapsulated and forwarded to the specified port. If the packet does not hit any entry, then the packet is dropped. It is simple to add more complex policy rules such as a 5 tuple ACL.

```
/*
* This control performs the overlay policy including L2 encap with VXLAN
*/
control overlay_encap(
    inout headers_t headers,
    in nv_standard_metadata_t std_meta,
    inout metadata_t user_meta,
    inout nv_empty_metadata_t pkt_out_meta
) {
    NvDirectCounter(NvCounterType.PACKETS_AND_BYTES)
encap_counter;

    action deny() {
        nv_drop();
    }
```

```
    action vxlan_v4_encap(nv_mac_addr_t underlay_src_mac,
nv_mac_addr_t underlay_dst_mac,
                  nv_ipv4_addr_t underlay_sip, nv_ipv4_addr_t
underlay_dip, bit<24> vni, nv_logical_port_t port) {
        encap_counter.count();
        nv_set_vxlan_v4_underlay(headers, false, underlay_dst_mac,
underlay_src_mac, 0, underlay_sip, underlay_dip, vni);
        nv_send_to_port(port);
    }
    table encap_v4_table {
        key = {
            headers.ipv4.dst_addr : exact;
        }
        actions = {
            vxlan_v4_encap;
            deny;
        }
        size = ENCAP_TABLE_SIZE;
        default_action = deny;
        direct_counter = encap_counter;
    }

    apply {
       if (headers.ipv4.isValid() && (user_meta.was_decapped ==
1)) {
            encap_v4_table.apply();
       }
    }
}
```

The decapsulation control simply checks if the packet is VXLAN, and decapsulates it. From there the packet can be sent directly to a port, or hair-pinned back to the wire.

```
/*
* This control is for packets from wire to host (RX)
```

```
* and includes policy for L2 decap
*/
control decap_flow(
    inout headers_t headers,
    in nv_standard_metadata_t std_meta,
    inout metadata_t user_meta,
    inout nv_empty_metadata_t pkt_out_meta
) {
    NvDirectCounter(NvCounterType.PACKETS_AND_BYTES)
decap_counter;

    action deny() {
        nv_drop();
    }

    action decap() {
        decap_counter.count();
        nv_l2_decap(headers);
        user_meta.was_decapped = 1;
    }

    action to_port(nv_logical_port_t port) {
        nv_send_to_port(port);
    }

    action decap_to_port(nv_logical_port_t port) {
        decap_counter.count();
        user_meta.was_decapped = 1;
        nv_l2_decap(headers);
        nv_send_to_port(port);
    }

    table decap_v4_table {
        key = {
            headers.vxlan.vni : exact;
        }
```

```
        actions = {
            decap;
            to_port;
            decap_to_port;
            deny;
            NoAction;
        }
        size = DECAP_TABLE_SIZE;
        direct_counter = decap_counter;
        default_action = deny;
    }

    apply {
        if (headers.vxlan.isValid()) {
            decap_v4_table.apply();
        }
    }
}
```

The main control checks the ingress port to determine if the packet is Network to Host, or Host to Network. Depending on the direction, it applies the decap_flow control, or performs an overlay encapsulation.

```
control gateway(
    inout headers_t headers,
    in nv_standard_metadata_t std_meta,
    inout metadata_t user_meta,
    inout nv_empty_metadata_t pkt_out_meta
) {
    overlay_encap() over;
    decap_flow() decap;

    /* user should add entries that correspond to the wire ports
     * A hit means this is an RX packet, miss means a TX packet
     */
```

```
    table direction_table {
        key = {
            std_meta.ingress_port : exact;
        }
        actions = {
            NoAction;
        }
        default_action = NoAction;
        const entries = {
            (WIRE_PORT) : NoAction();
        }
    }

    apply {
        user_meta.was_decapped = 0;
        if (direction_table.apply().hit) {
            decap.apply(headers, std_meta, user_meta,
pkt_out_meta);
        }
        over.apply(headers, std_meta, user_meta, pkt_out_meta);
    }
}

NvDocaPipeline(
    packet_parser(),
    gateway()
) main;
```

See the full DPL example gateway.p4

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