Network as a Service Architecture

draft-liu-nvo3-naas-arch-01

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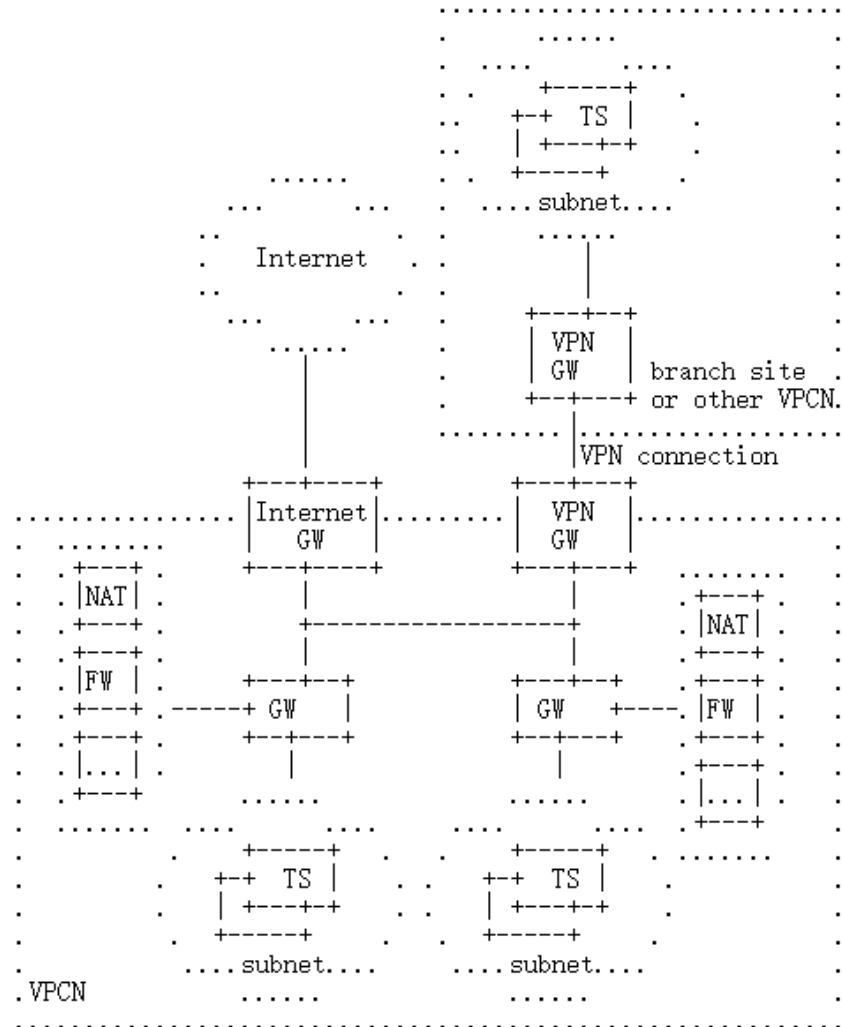Liang Xia<liangxia@Huawei.com>
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Motivation

✓ With public cloud, network capabilities can be sold as a service to datacenter tenants provide by operator:

- IP address, VLAN, VxLAN, Bandwidth, Load Balancing, Firewall,…

✓ With NaaS, cloud network can overcome bottleneck of traditional technologies. Such as 4K VLAN.

✓ Tenant can custom their own `virtual private cloud network(VPCN)`

- i.e., network topology, VPN connection, network services, etc.

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                                   .   ....   +-----+           .
                                   ..  +-+ TS |         .
                                   .. +-+ |    +---+-+          .
                                   .. |    +-----+          .
                      ......        ....subnet....          .
                   ...      ...     ...            |          .
                 ..           ..      +---+--+          .
                 .  Internet    . .   | VPN  |          .
                 ..           ..      | GW   | branch site .
                 ...      ...         +-+-+--+ or other VPCN.
                   ......             .......|............
                      |                      |VPN connection
                      |        +---+----+     +---+--+
        ...............|Internet|........|  VPN |.............
        . .+---+ .     |  GW    |        |  GW  |      .
        . .|NAT| .     +---+----+        +---+--+   ......
        . .+---+ .         |                 |      . +---+ .
        . .+---+ .         +---------------+       . |NAT| .
        . .|FW | .     +---+-+             |        . +---+ .
        . .+---+ .-----+ GW  |          +--+--+   .+---+ .
        . .+---+ .     +-+---+          | GW  +----.|FW | .
        . .|...| .        |             +-+---+    . +---+ .
        . .+---+ .        |                |       .+---+ .
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        . .     +-----+ .         +-----+        .
        .  .  +-+ TS | .. +-+ TS | .      .
        .  .  | +---+-+ . .| +---+-+  .      .
        .  .  +-----+ .         +-----+    .      .
        . ....subnet....    ....subnet....      .
        .VPCN     ......          ......        .
        ...........................................
```

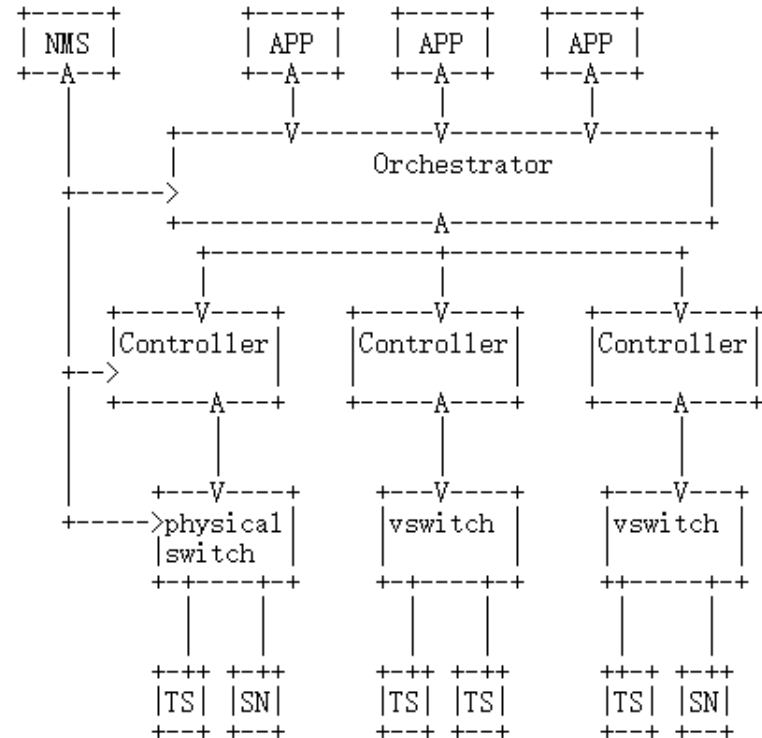`virtual private cloud network`

New features

- **Network virtualization:** NaaS must support Multi-tenancy requirement. And it should hide the implementation details of the network infrastructure

- **Close integration with virtual IT resources (compute, storage):** NaaS must have the capabilities of VM auto-discovery, integrated operation/provision together with IT resources;

- **Elasticity/High Availability:** NaaS must have the capabilities of on-demand bandwidth allocation, dynamic link/network creation, dynamic and geographically distributed pools of shared ICT resources, etc;

- **Flexible service chain:** Flexible interposition of various middle boxes in the NaaS network becomes an essential and valuable requirement for it and an IETF WG (SFC: Service Function Chaining) has been created to study and resolve the series of requirements;

- **SDN paradigm:** SDN is optional paradigm, but provides great flexibility and efficiency in network resource management, optimized path selection for DC interconnection;

- **Automation:** This feature should be achieved in many aspects for saving manual labor, which includes automatic collection of the network topology information, policy auto distribution, OAM, auto recovery, etc;

- **Open interface to user:** Making virtual network resource can be managed by user themselves. For simplifying the operation, this interface should provide network resource

Main Challenges

- **Constraints of physical DC:** Traditional network technologies such as vlan, broadcast domain, ACL, firewall setting, etc, have put so much constraints because of their location dependent feature;

- **Distributed subnet:** One L3 subnet can span across the whole DC by virtualization technology. Hosts in a L3 subnet are no longer limited in one location. This kind of distributed subnet scenario brings new challenges of hosts' unified identification and access control;

- **Programmable network:** SDN paradigm needs to define information model and data model used by the related interfaces, and the information mapping between overlay and underlay network;

- **On-demand and flexible service chain:** It means dynamic service awareness and automatic service provision;

- **End to end connection provision:** How to provide the End to end VPN service to users when the wan/man network and DC network are separated? How to integrate enterprise's current infrastructure and NaaS in cloud seamlessly and securely? How to guarantee the End to end SLA, including bandwidth, latency, etc?

- Backwards compatibility and smooth migration

- Security related issue

NaaS Architecture

- **Application layer**
  - application (APP) and/or network management system (NMS). Applications having the visibility to network resource is beneficial for them to use network resource better. Various standard interfaces can be used among applications and orchestrator
- **Orchestrator layer**
  - integrating all the resource and controlling them in centralized way. By providing standard interface in northbound and southbound, it can support different types of controller and hide the difference from application layer;
- **Controller layer**
  - responsible for transforming service requests from application layer into forwarding information (e.g., flow table) in the network devices.
- **Network layer**
  - Traffic forwarding for tenant systems and service node.

```
+-----+          +-----+   +-----+   +-----+
| NMS |          | APP |   | APP |   | APP |
+--A--+          +--A--+   +--A--+   +--A--+
   |                |         |         |
   |          +-----V---------V---------V-------+
   |          |             Orchestrator        |
+------>      |                                 |
   |          +-----------------A---------------+
   |          +-----------------+---------------+
   |          +--------------+----------------+
   |          |              |                |
   |     +-----V----+   +-----V----+   +-----V----+
   |     |Controller|   |Controller|   |Controller|
+-->     +------A---+   +------A---+   +------A---+
   |            |              |              |
   |       +---V----+     +---V----+     +----V---+
+----->physical|     |vswitch |     |vswitch |
   |     |switch  |     |        |     |        |
   |     +-+----+-+     +-+----+-+     ++-----+-+
   |       |    |         |    |         |    |
   |     +-++ +-++      +-++ +-++      ++-+ +-++
   |     |TS| |SN|      |TS| |TS|      |TS| |SN|
   |     +--+ +--+      +--+ +--+      +--+ +--+
```

Next step

- Comment for narrowing down …

THANKS

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