

APP NOTES

CloudCO-APPN-002- Network Enhanced Residential Gateway (NERG) Service Initialization with Flat Logical Subscriber Link (LSL) Connectivity

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1 Summary/Objective

This application note describes the establishment of NERG (TR-317) service for a subscriber within a CloudCO domain instance. The NERG service in this application note supports Flat Logical Subscriber Link (LSL) connectivity model.

This application note complies with the NERG use case defined in section 6.1.2 of WT-416.

2 Assumptions and Preconditions

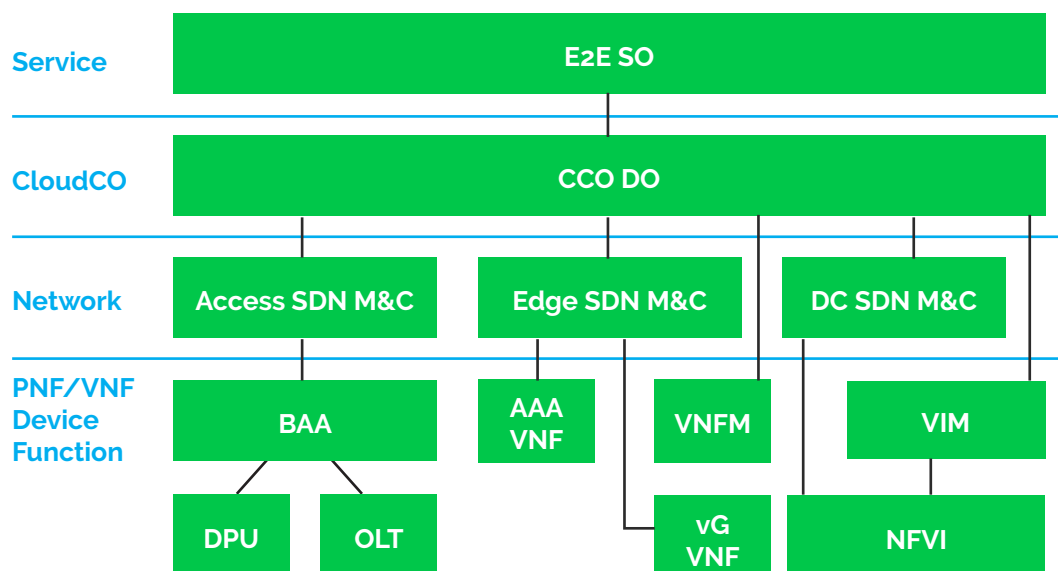
1. The Cloud CO Domain instance is already fully bootstrapped.
2. Tenant access is authorized by a AAA VNF using EAP. The AAA VNF can use a local database or use Radius. 802.1x will be used to send EAP requests and responses to the Premise PNF (BRG).
3. The Premise PNF (BRG) can be managed using legacy Management techniques (ACS/TR-6g) or be managed by the Edge SDN M&C which integrates the ACS module. The Premise PNF (BRG) is using an untagged UNI, and needs to support 802.1x based authentication.
4. The physical connectivity between Premise PNFs (BRGs) at the tenant home premise, Access PNFs, Switch Fabric, and Network I/O has been established.
5. All Controllers are applications running inside the NFVI, Controllers can talk to the elements they manage. This was all deployed in the previous bootstrapping stage (See CLOUDCO-APPN-000).

3 Description of the System

The E2E SO issues an Internet Access Service creation request to the CCO DO via the CCO NBI.

CCO DO orchestrates the establishment of appropriate network service by requesting the:

- Access and Edge SDN M&C and VIM to configure a pre-activation trail (control and user plane) from the home premise to the Access PNF, and from the Access PNF to the AAA VNF.
- Edge SDN M&C to configure the AAA VNF with the tenant's authentication credentials and account.
- VIM to deploy NERF VNFM to manage the lifecycle of the future vG VNF.
- VNFM to configure vG VNF with the composing functions (e.g., LAN private address pools, home DHCP server, NAT rules etc) for the tenant.
- Leveraging Edge, DC and Access SDN M&C Controllers, as well as the VIM to establish end to end user-plane connectivity.



4 Components

Component Framework Name	Component Description
CCO DO	Cloud CO Domain Orchestrator
Edge SDN M&C	Edge SDN Management and Control: TR-384, WT-411, WT-413 - Provides SDN Management and Control of the Routing and CCO awareness BRG, as well as control plane functions that have been virtualized such as AAA and vG VNFs.
Access SDN M&C	Access SDN Management and Control: TR-384, WT-411, WT-413 - Provides SDN Management and Control of the DPU and OLT via the BAA
DC SDN M&C	Data Center SDN Management and Control: WT-411 - Provides SDN Management and Control of the NFVI , in this case the physical network fabric.
VIM	Virtualized Infrastructure Manager: WT-411, ETSI NFV - Controls the NFVI, deploys VNFs and interconnects them.
BAA	Broadband Access Abstraction layer: TR-384, WT-411, WT-413: Aggregates and virtualizes access to DPUs and vOLT PNFs.
Premises PNF (BRG)	The bridged residential gateway: TR-317-located at the residential customer premise.
vG	The virtual gateway VNF: TR-317, TR-384-hosted in CCO Domain.
DPU	Access PNF
OLT	OLT PNF Premises PNF
VNFM	VNF Manager: ETSI NFV: Manages the lifecycle of the vG VNFs.

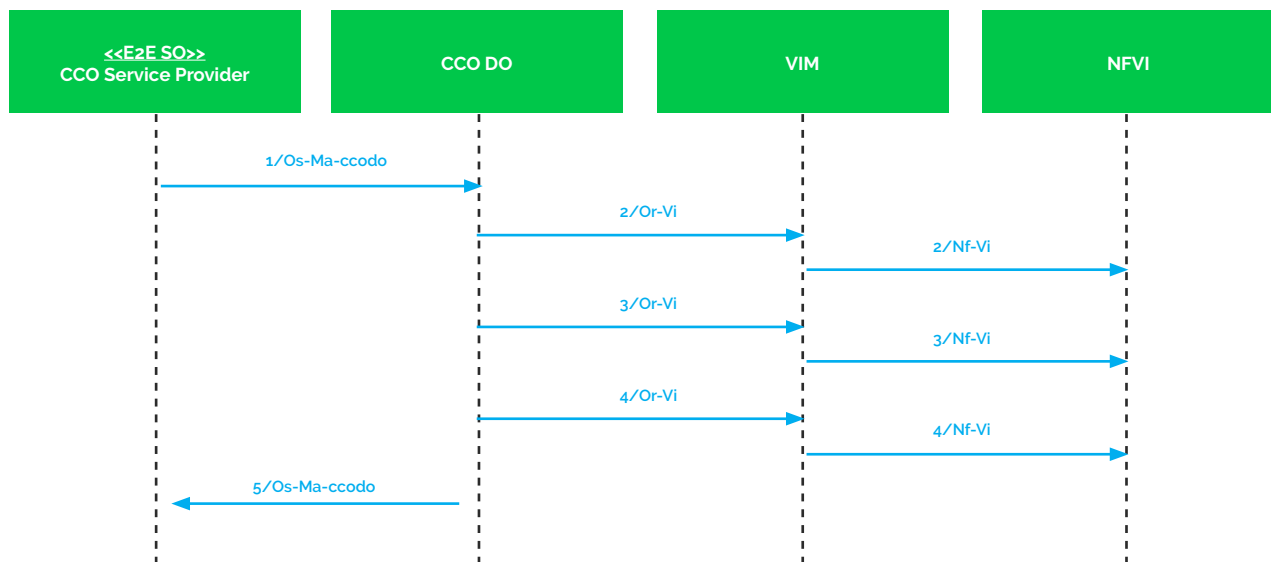
5 Actors

Actor Name	Actor Description	Actions at CCO Domain
Service Provider	The wholesale service provider offers the CCO infrastructure to retail Internet service provider.	1. Create Internet Access Service for the retail Internet SP.
retail Internet Service Provider	The service provider rents the CCO resources from Cloud CO Operator and offers NERG service to the service user.	1. Onboard NERG Service for the Service User. 2. Creates service user for a tenant
Service User	Subscriber of the NERG service.	1. User connects the Premises PNF to the network and enters the retail Internet service provider supplied user credentials into the Premises PNF.

6 Interactions

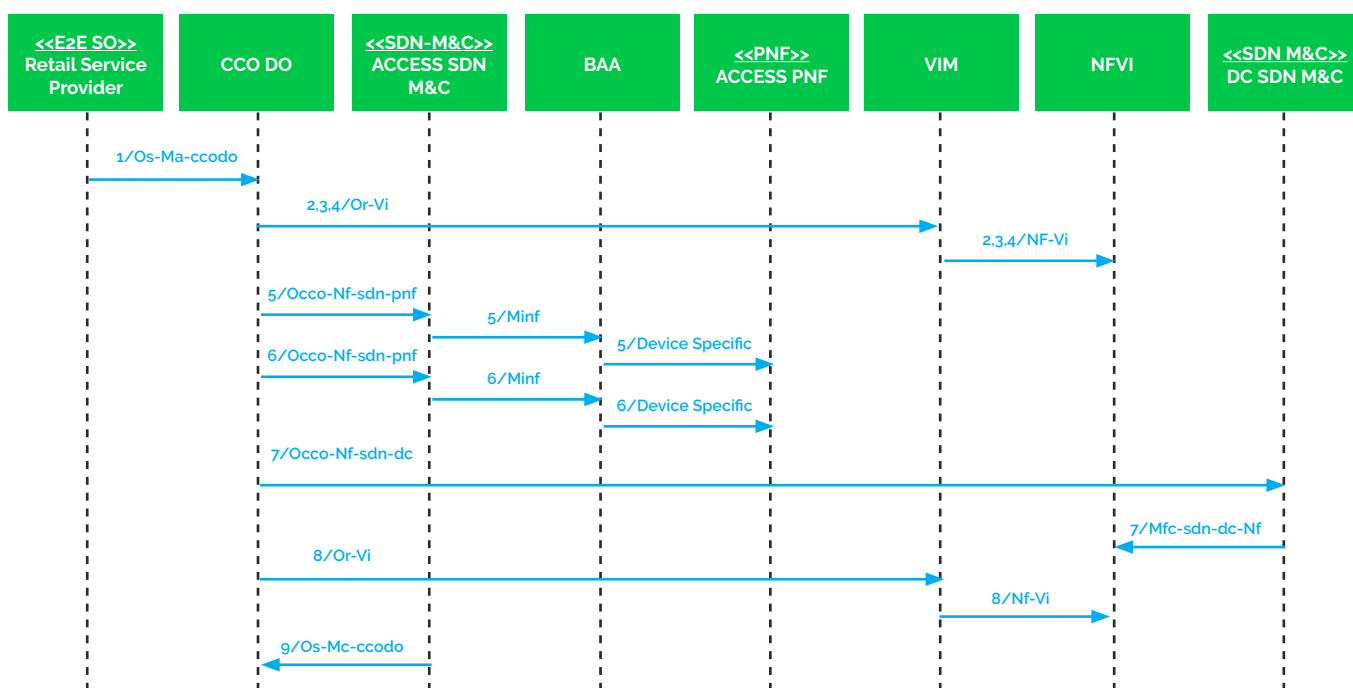
6.1 Interaction 1: Create Internet Access Service

1. CCO DO receives an Internet Access Service creation request. The CCO Service Provider assigns the Internet Access Service instance to the retail Internet Service Provider:
2. CCO DO requests VIM to create a Distributed Router across the NFVI through the VIM, associated with a pool of public IP addresses.
3. CCO DO requests VIM to create an overlay network to connect the uplink of Distributed Router,
4. CCO DO requests VIM to create a bridge to connect the overlay network to a pre-created S-VLAN configured on one of the network facing interfaces of the CloudCO Domain.
5. CCO DO reports 'Service Ready'.



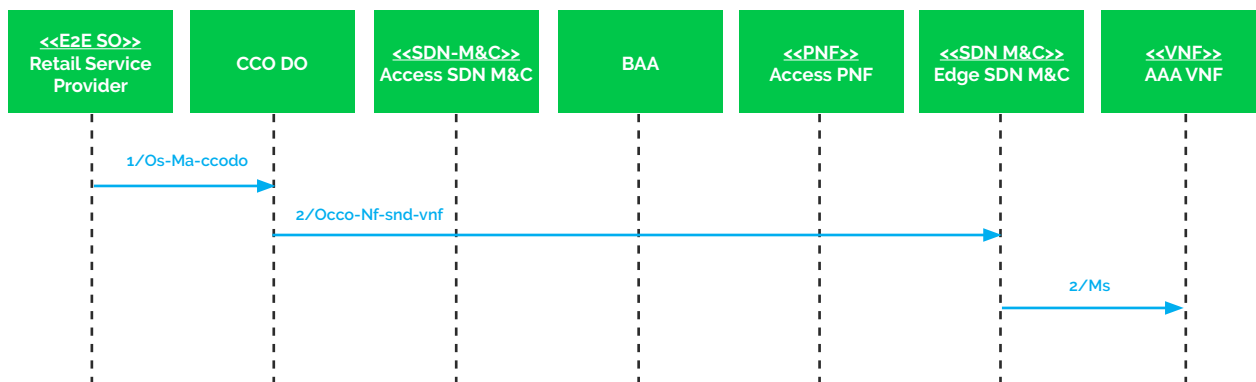
6.2 Interaction 2: Create NERG with Flat LSL Service

1. CCO DO receives an NERG service onboard request from a retail Internet Service Provider.
2. CCO DO requests VIM to create an NERG VNFM instance inside the CloudCO Domain.
3. CCO DO requests VIM to deploy an AAA VNF inside the Cloud CO Domain for the retail Internet Service Provider.
4. CCO DO requests VIM to establish the connectivity between the Access SDN M&C and the AAA VNF.
5. CCO DO requests Access SDN M&C to create an S-VLAN on the Access PNF via the BAA, as well as assigning Access UNIs to that S-VLAN, as well as enabling split-horizon forwarding on that S-VLAN.
6. CCO DO requests Access SDN M&C to provision the Access PNF via the BAA to redirect 801.1x packets within the context of that S-VLAN to it, while blocking all the rest.
7. CCO DO requests DC SDN M&C to configure that S-VLAN on the switch attached to the Access PNF on all of its ports.
8. CCO DO requests VIM to create a new overlay network inside the NFVI and create a bridge between the S-VLAN and the new overlay network.
9. CCO DO reports 'Service Ready'.



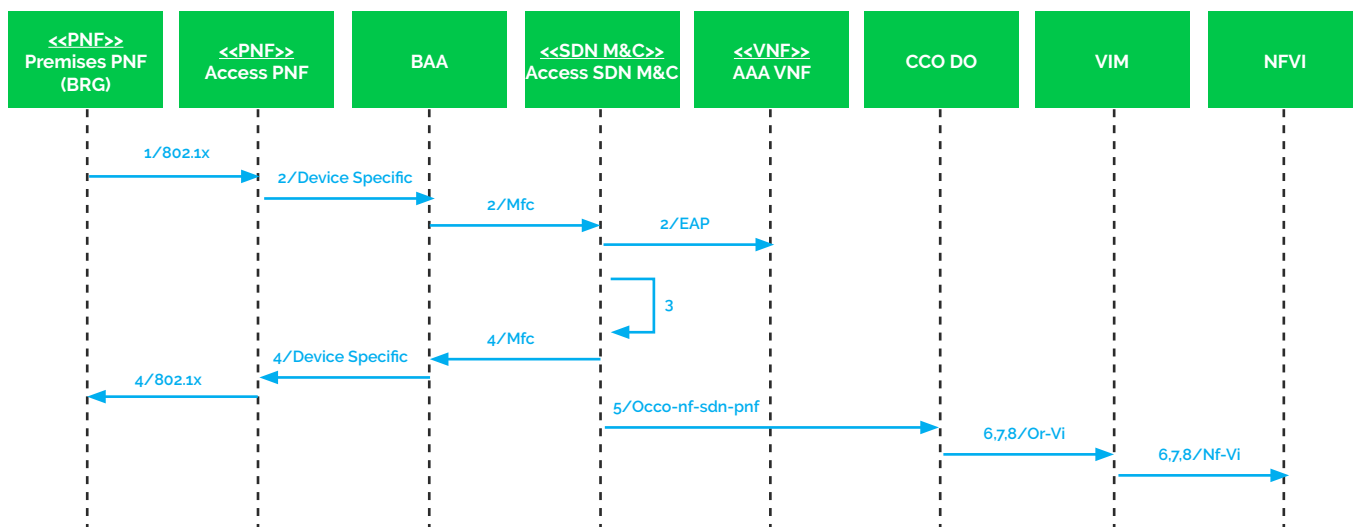
6.3 Interaction 3: Create NERG Service User

1. CCO DO receives a NERG Service User creation request with tenant credentials.
2. CCO DO requests Edge SDN M&C to configure the AAA VNF with the tenant credentials.



6.4 Interaction 4: Activate NERG Service (Successful authentication)

1. The Premises PNF (BRG) attaches to the Access Network, and provides 802.1x credentials for authentication.
2. Access PNF sends, via the BAA and Access SDN M&C, The EAP information from the 802.1x packet toward the AAA VNF. The AAA VNF authenticates the tenant and returns the response.
3. Upon successful authentication, the Access SDN M&C registers a port activation, i.e allowing now other type of packets on the Access UNI port.
4. The Access SDN M&C reports a port activation to the BAA which reports it to the Access PNF which establishes L2 connectivity between the enduser port and the Access PNF NNI via S-VLAN forwarding.
5. Access SDN M&C reports a tenant activation to the CCO DO with the attachment point.
6. CCO DO requests VIM to deploy a vG instance and establish the connectivity between the vG VNF and the the Edge SDN M&C. The vG VNF is managed via the Edge SDN M&C or the NERG VNFM.
7. CCO DO requests VIM to connect vG's LAN facing interface to the aforementioned overlay network (created in step 8 of Interaction 2).
8. CCO DO requests VIM to create another new overlay network inside the NFVI and connect this overlay network between the WAN facing interface of the vG and the Distributed Router (created in step 2 of Interaction 1).



7 Success Criteria

7.1 Interaction 1:

1. CCO DO maintains the Internet Access Service request.
2. Routed User Plane Connectivity is created, from the Distributed Router to the Network I/O of CCO Domain.

7.2 Interaction 2:

1. CCO DO onboards the NERG Service.
2. Management and control plane is established between the Premise PNF (BRG) and the AAA VNFs.
3. Management and control plane is established between the Premises' physical termination and Access SDN M&C via the BAA.

7.3 Interaction 3:

1. NERG Service User is created.
2. AAA VNF is configured with the tenant information.

7.4 Interaction 4:

1. The vG instance is instantiated.
2. The Service User behind the Premises PNF (BRG) accesses the Internet service.

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