OcNOS® OLT

Application Note

Overview

OcNOS-OLT is network operating system for disaggregated XGS PON devices. This document describes applicable use case scenarios for OcNOS-OLT.

A Brief history of PON (Passive Optical Network)

A Passive Optical Network (PON) is a technology for providing broadband access services to end users. It is often referred as last mile connectivity between end user and Service Provider network. It uses a single optical fiber and unpowered optical splitters to provide point to multipoint access network connecting multiple customers to the service provider network over the same fiber. PON was developed to meet growing bandwidth demand from the residential and business customers. Over a period of time, PON technology evolved from offering bandwidth of few megabits to gigabits per second.

PON TECHNOLOGY	SPECIFICATION	CHARACTERISTICS
APON/BPON (ATM PON/ Broadband PON	G.983	622 Mbits/sec downstream and 155 Mbits/sec upstream
GPON	G.984	2.5 Gbits/sec downstream and 1.25 Gbits/sec upstream
XG-PON	G.987	10 Gbits/sec downstream and 2.5 Gbits/sec upstream
XGS-PON	G.9807.1	10 Gbits/sec downstream and 10 Gbits/sec upstream

PON Overview

A PON network consists of an Optical Line Terminal (OLT), Optical Network Units (ONUs) and an Optical Distribution Network (ODN).

OLT is a device that implements PON protocol, defined by one of the ITU-T GPON/XG(S)-PON specification listed above. It acts as the endpoint hardware device in a Passive Optical Network. It is located in central office and its main function is to control the data flows across the optical distribution network (ODN), going upstream as well downstream direction.

ONU is a device located at customer premises and provides various different types of ports for connecting end use devices like computer, Telephone, TV etc.

The OLT and ONU are connected over optical distribution network (ODN) which consists of optical fibers and one or more passive optical splitters.

The management and control of ONUs are performed by OLT using a protocol called ONU Management and Control Interface (OMCI) defined by ITU-T specification G.988.
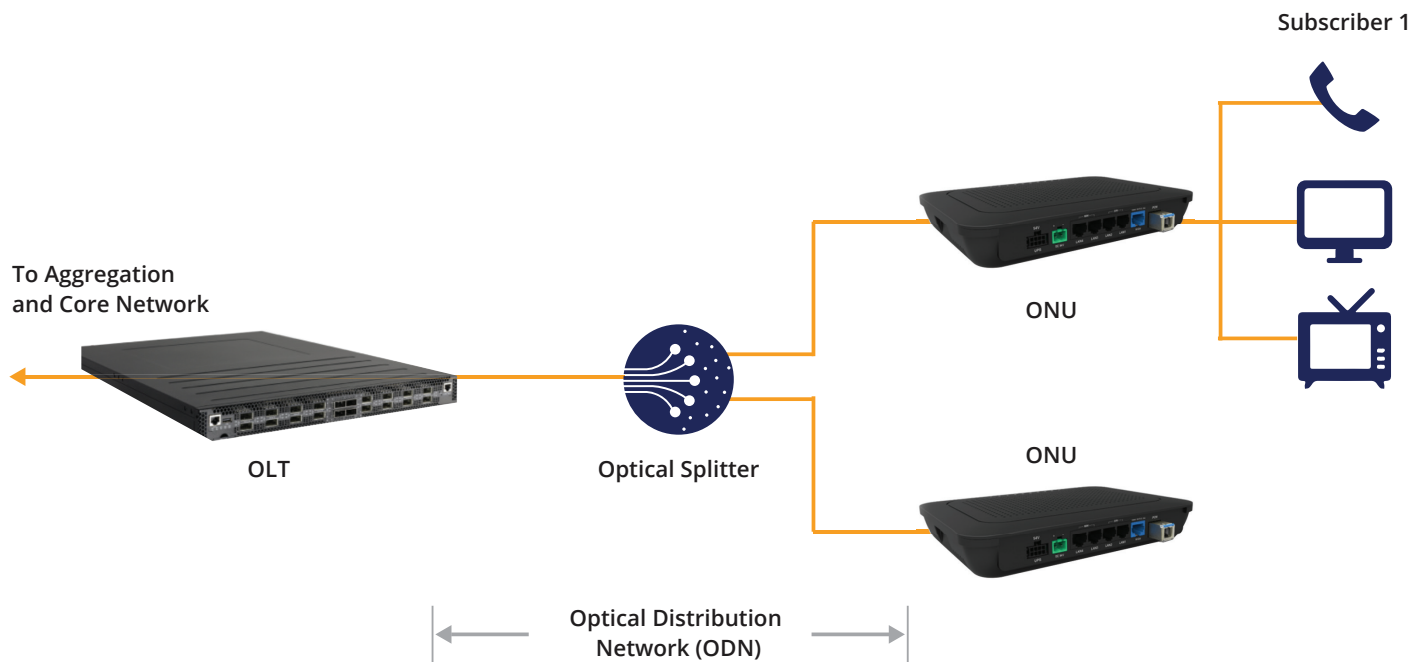

Figure 1: PON Access Network

Working Principles of GPON

GPON technology uses a data framing transport scheme called GEM (GPON Encapsulation Method). GEM provides a connection oriented, variable length framing mechanism for transport of data services over PON. A GEM Port is a logical channel that carries a specific service flow between the OLT and ONU. Each of these individual logical channels are identified by a 12 bit number called GEM Port-ID, which is assigned by OLT. There can be several GEM ports associated with a GPON interface.

One or more GEM ports are combined into a transmission container (T-CONT) forming a basic unit of service flow in upstream direction. OLT then uses dynamic bandwidth allocation scheme to schedule upstream transmission of flows in T-CONTs. A T-CONT is identified uniquely by Alloc-ID which is allocated by OLT. An ONU supports multiple T-CONTs configured for different service types.
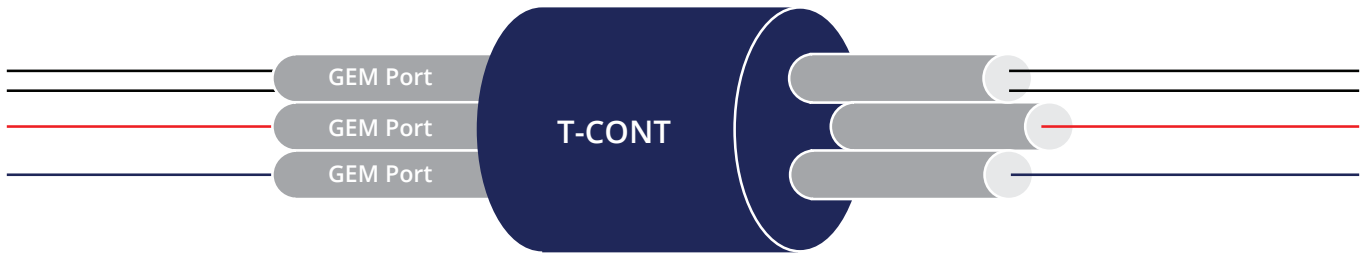
Figure 2: GEM Port and T-CONT

On ONU user port, ingress traffic is classified into VLANs with various Ethernet priorities based on a number of criteria: physical port, VID, VLAN, P-bits, EtherType and/or DSCP. Any combination of these criteria can be used to determine the Ethernet priority. The VID and EtherType can be used to determine a new VID. Once the traffic has been assigned a VLAN and Ethernet precedence, these two Ethernet header components are used to select an upstream GEM port so that proper QoS can be applied to the flow. A GEM port is mapped into one and only one T-CONT. Similarly for egress, the ONU is responsible for forwarding traffic received from GEM ports on the PON to the appropriate user port.
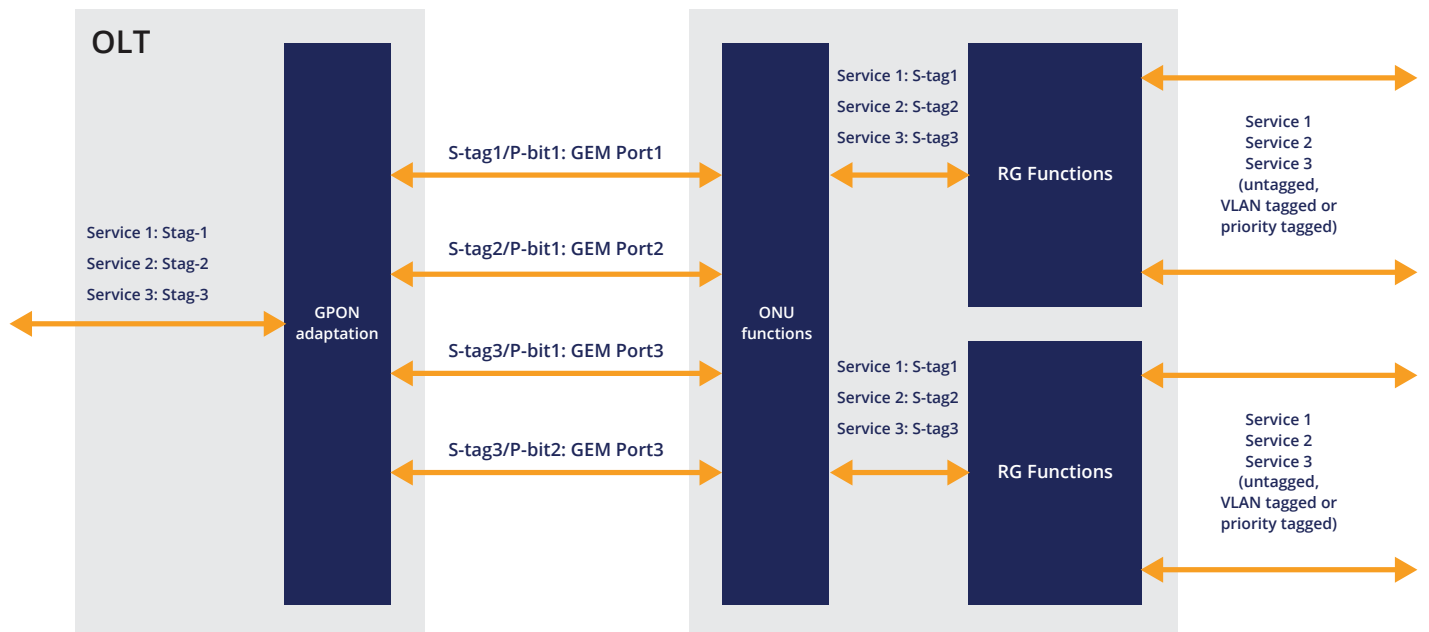
Figure 3: Traffic flow in GPON network

Downstream Traffic flow (From OLT to ONU)

The OLT multiplexes the GEM frames onto the transmission medium using GEM Port-ID as key to identify the GEM frames that belong to different downstream logical connections. Each ONU receives all GEM frames. It then filters the downstream GEM frames based on their GEM Port-ID and processes only the GEM frames that belong to that ONU.

Since the downstream data in PON network is broadcast to all ONUs, there are risks of eavesdropping. To counter this security threat, GPON system uses AES encryption to encrypt the GEM payloads. Since each ONU negotiates a different pair of cypher keys with the OLT, an ONU can't decode the data which belongs to another ONU.

Upstream Traffic flow (From ONU to OLT)

In the upstream direction traffic multiplexing functionality is distributed. The OLT grants upstream bandwidth allocation to the T-CONTs within the ONUs. The bandwidth allocation to different T-CONTs are multiplexed in time as specified by the OLT in the bandwidth map transmitted downstream. Within each bandwidth allocation, the ONU uses GEM Port-ID as a multiplexer key to identify the GEM frames that belong to different upstream logical connection and transmits it.

OcNOS-OLT Features Overview

OcNOS-OLT version 1.1 supports following features.

OLT Hardware

OcNOS-OLT currently supports EdgeCore ASX-vOLT16, a 16x10G port XGS PON white box with 4x100G/40G QSFP28 fixed ports. All 10G ports supports standard XGS-PON transceivers. The QSFP28 ports supports 100G and 40G operation modes as well as being configurable as 4x25G or 4x10G modes using breakout cables.

Figure 4: EdgeCore ASXvOLT16

ONU Hardware

OcNOS-OLT solution has been validated with Alpha Networks PON – 3400B ONU hardware. However in principle OcNOS-OLT should work with any ONU device which conforms to XGS-PON and OMCI specification.

ONU Discovery

There are two ways OcNOS-OLT can discover the ONU –

1. Manual Provisioning of ONU: In this mode, user sets the ONU provisioning mode to "manual" and configure the ONU statically

2. Automatic Provisioning of ONU: In this mode, user sets the ONU provisioning mode to "automatic" and OLT automatically discovers all connected ONUs.

ONU Profile

ONU profile allow users to define a mapping of GEM port to T-CONT and assign this mapping to logical UNI Ports. It also lets user to put the traffic associated with a particular GEM port to a specific upstream and downstream priority queues according to the p-bits of the Ethernet frames.

VLAN Translation Profile

VLAN translation profile lets the user classify the customer traffic according to the VLAN tags and allow traffic with only specific VLAN tags in the upstream/downstream direction. The OcNOS-OLT version 1.1 supports 1:1 VLAN forwarding scheme. Under this scheme, forwarding relies on unique one to one binding between user port and a VLAN. In upstream direction, a frame received on a port has one or two VLAN tags added and is sent to the network. In the downstream direction, a frame received from the network is stripped off one or two VLAN tags and sent to the corresponding port.

QoS Profile

The QoS profile allow users to configure different quality of service parameters like committed information rate (CIR), peak information rate(PIR) and burst size for different service flows.

Flows

Flow is the abstracted representation of a subscriber service configured for a given user. OLT users can configure one or more flows per UNI port using different combination of S-VLAN and C-VLAN.

DHCP Relay

OcNOS-OLT supports Layer-2 DHCP relay with option-82 to forward DHCP packets from the subscribers to DHCP server.

Access Control List (ACL)

OcNOS-OLT supports ACL to match the subscriber traffic based on flow id, remote IP address and/or TCP/UDP port number. The matching traffic can be allowed, dropped, or trapped to the CPU.

Applicable Use Case Scenario

OcNOS-OLT version 1.1 together with EdgeCore ASX-vOLT16 and any suitable ONU can be used to deploy 10G XGS-PON access network providing triple play services to residential and business customers.
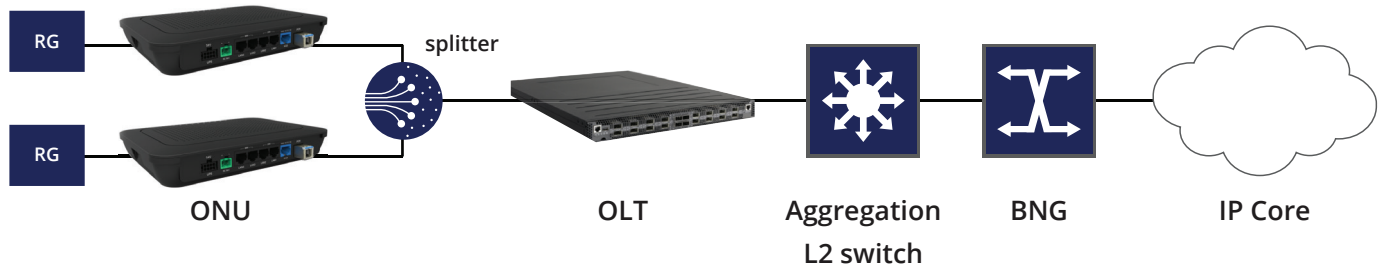

Figure 5: OcNOS-OLT deployment scenario

On a particular user port of an ONU, a subscriber's service is identified using a VLAN tag and P-bit. These services are configured as "Flows" which carries subscriber's traffic. Different flows are configured for different services. Associated with each flow is a set of rules and action to classify the incoming traffic, a translated VLAN tag to be put onto user traffic and QoS treatment this traffic stream needs to be subjected to.

The traffic classification rules and associated actions are configured as "Translation Profile". All ingress traffic on a ONU user port will be classified according to the Translation Profile. Matching traffic are allowed and unmatched traffic are dropped.

After classification is done, the actions specified in the translation profile are executed. The action could include remarking of P-bit and either remove the customer VLAN or do nothing. For tagged traffic, "remove" operation must be provided and for untagged traffic only operation "none" is allowed.

After traffic is classified and associated actions are executed as per Translation Profile, the traffic are mapped to a GEM Port and T-CONT. This mapping is done as per ONU Profile configured on ONU and activated on its user ports. Using GEM Port and T-CONT, traffic is carried to the OLT where GPON terminates and Ethernet frame egresses out of OLT NNI port configured for this flow. The traffic will be subjected to the configured QoS treatment when it egresses the OLT NNI port.
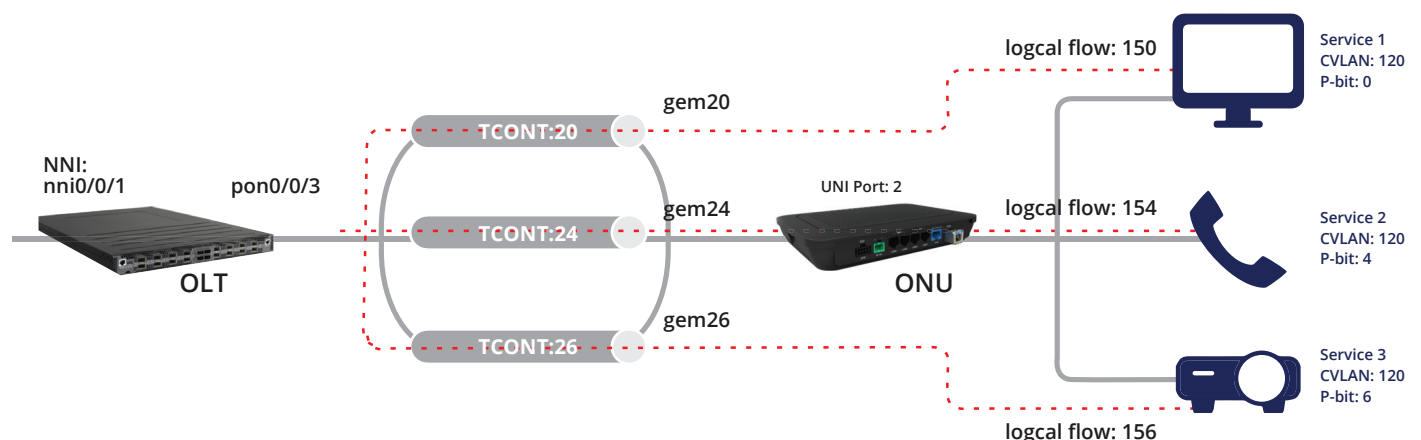

Figure 6: Logical flows

Following example below describes how to configure triple play service for a given user and provide quality of services specific to each service.

Configure user traffic Flows

Following is the sample configuration for configuring a flow. The flow has a "flow-id" and an UNI end, a NNI end and a QoS profile. The UNI end consists of ONU ID, UNI Port ID (UNI Port ID maps to physical user port number of ONU), and a translation profile. The NNI end consists of the OLT ID and the OLT port connected upstream towards an Ethernet aggregation device.

```
flow-id 154
  uni
    onu-id 2 uni-port-id 2 vlan-tag 154 translation-profile-name cvlan120_p4
  nni
    olt-id 0 nni-port-name nni0/0/1
  qos
    qos-profile-name 500Mbps
  !
```

With the above configuration, the incoming user traffic on the ONU user port-2 will be classified according to the translation profile "cvlan120_p4". The VLAN tag in the matching traffic is removed and P-bit is remarked with value 4 as per the action specified in the translation profile.

```
translation-profile profile-name cvlan120_p4
  classification
    vlan-type tagged vlan-id 120 p-bits 4
  treatment
    p-bits 4 operation remove-vlan
  !
```

The user flow now needs to be mapped to a GEM Port and T-CONT for carrying the traffic to the OLT. This is done using an ONU profile configured on the ONU user port.

```
onu-profile profile-name FTTB_ALPHA_ONU
  uni port-id 2
    gem-port-name gem26 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
    gem-port-name gem24 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
    gem-port-name gem20 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0

 t-cont tcont-20
    gem-port-name gem20
  t-cont tcont-24
    gem-port-name gem24
  t-cont tcont-26
    gem-port-name gem26
 !
```

After traffic reaches the OLT, it egresses out of OLT NNI interface and are subjected to the QoS treatment configured for this flow.

```
qos-profile profile-name 500Mbps
  downstream
    cir 500 mbps pir 501 mbps pbs 1 kbytes
  upstream
    cir 500 mbps pir 501 mbps
  !
```

The full configuration for this use case has been listed below.

```
Software version: EC_ASXVOLT16-OcNOS-3.0.17a-SP_OLT_LITE_16P-S0-P0 06/20/2020 15:55:04
 Copyright (C) 2020 IP Infusion. All rights reserved

 Software Product: OcNOS, Version: 3.0.17a
 Hardware Model: Edgecore ASXvOLT16
 Software Feature Code: SP-OLT-LITE-16P
 System Configuration Code: S0
 Package Configuration Code: P0
 Software Baseline Version: 1.0.0.720

Installation Information:
 Image Filename: EC_ASXVOLT16-OcNOS_SP-3.0.17a-SP_OLT_LITE_16P-S0-P0-installer
 ONIE SysInfo: x86_64-accton_asxvolt16-r0

OcNOS#show running-config
!
! Software version: EC_ASXVOLT16-OcNOS-3.0.17a-SP_OLT_LITE_16P-S0-P0 06/20/2020 15:55:04
!
!Last configuration change at 12:04:41 UTC Sun Jan 02 2000 by root
!
no service password-encryption
!
ip vrf management
!
no ip domain-lookup
ip domain-lookup vrf management
tfo Disable
errdisable cause stp-bpdu-guard
feature telnet vrf management
feature ssh vrf management
snmp-server enable snmp vrf management
snmp-server view all .1 included vrf management
feature ntp vrf management
ntp enable vrf management
username ocnos role network-admin password encrypted $1$1..r.jb/$VgBtm5fBlfc4yApKBNm.U.
feature rsyslog vrf management
!
interface pon0/0/1
 shutdown
!
interface pon0/0/2
 shutdown
!
interface pon0/0/3
```

```
!
interface pon0/0/4
 shutdown
!
interface pon0/0/5
 shutdown
!
interface pon0/0/6
 shutdown
!
interface pon0/0/7
 shutdown
!
interface pon0/0/8
 shutdown
!
interface pon0/0/9
 shutdown
!
interface pon0/0/10
 shutdown
!
interface pon0/0/11
 shutdown
!
interface pon0/0/12
 shutdown
!
interface pon0/0/13
 shutdown
!
interface pon0/0/14
 shutdown
!
interface pon0/0/15
 shutdown
!
interface pon0/0/16
 shutdown
!
interface eth0
 ip vrf forwarding management
 ip address dhcp
!
interface lo
 ip address 127.0.0.1/8
 ipv6 address ::1/128
!
interface lo.management
 ip vrf forwarding management
 ip address 127.0.0.1/8
 ipv6 address ::1/128
!
interface nni0/0/1
 speed 40g
!
interface nni0/0/2
```

```
!
interface nni0/0/3
!
interface nni0/0/4
!

pon-configuration
 translation-profile profile-name cvlan120_p0
  classification
   vlan-type tagged vlan-id 120 p-bits 0
  treatment
   p-bits 0 operation remove-vlan
 !
 translation-profile profile-name cvlan120_p4
  classification
   vlan-type tagged vlan-id 120 p-bits 4
  treatment
   p-bits 4 operation remove-vlan
 !
 translation-profile profile-name cvlan120_p6
  classification
   vlan-type tagged vlan-id 120 p-bits 6
  treatment
   p-bits 6 operation remove-vlan
 !
onu-profile profile-name FTTB_ALPHA_ONU
  uni port-id 4
   gem-port-name gem44 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
   gem-port-name gem40 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0
   gem-port-name gem46 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
  uni port-id 0
   gem-port-name gem00 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0
   gem-port-name gem06 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
   gem-port-name gem04 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
  uni port-id 2
   gem-port-name gem26 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
   gem-port-name gem24 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
   gem-port-name gem20 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0
  uni port-id 3
   gem-port-name gem30 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0
   gem-port-name gem34 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
   gem-port-name gem36 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
  uni port-id 1
   gem-port-name gem16 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
   gem-port-name gem10 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0
   gem-port-name gem14 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
  t-cont tcont-36
   gem-port-name gem36
  t-cont tcont-20
   gem-port-name gem20
  t-cont tcont-44
   gem-port-name gem44
  t-cont tcont-04
   gem-port-name gem04
  t-cont tcont-46
   gem-port-name gem46
  t-cont tcont-24
   gem-port-name gem24
  t-cont tcont-10
```

```
   gem-port-name gem10
  t-cont tcont-06
   gem-port-name gem06
  t-cont tcont-30
   gem-port-name gem30
  t-cont tcont-26
   gem-port-name gem26
  t-cont tcont-14
   gem-port-name gem14
  t-cont tcont-40
   gem-port-name gem40
  t-cont tcont-34
   gem-port-name gem34
  t-cont tcont-16
   gem-port-name gem16
  t-cont tcont-00
   gem-port-name gem00
!
qos-profile profile-name 500Mbps
 downstream
  cir 500 mbps pir 501 mbps pbs 1 kbytes
 upstream
  cir 500 mbps pir 501 mbps
!
olt-id 0
 onu-provisioning-type automatic administrative-state up
 dhcp on
!
 onu-id 2
onu-profile-name FTTB_ALPHA_ONU force-delete-flows no
 uni-port-id 0
  administrative-state unlock
 uni-port-id 1
  administrative-state unlock
 uni-port-id 2
  administrative-state unlock
 uni-port-id 3
  administrative-state unlock
 uni-port-id 4
  administrative-state unlock
!
flow-id 154
 uni
  onu-id 2 uni-port-id 2 vlan-tag 154 translation-profile-name cvlan120_p4
 nni
  olt-id 0 nni-port-name nni0/0/1
 qos
  qos-profile-name 500Mbps
!
flow-id 156
 uni
  onu-id 2 uni-port-id 2 vlan-tag 156 translation-profile-name cvlan120_p6
 nni
  olt-id 0 nni-port-name nni0/0/1
 qos
  qos-profile-name 500Mbps
!
```

```
  flow-id 150
   uni
    onu-id 2 uni-port-id 2 vlan-tag 150 translation-profile-name cvlan120_p0
   nni
    olt-id 0 nni-port-name nni0/0/1
   qos
    qos-profile-name 500Mbps
  !
 !
End
```

Validation

```
OcNOS#sh pon onu brief
  ONU-ID     OLT-ID    ADMIN-STATE OPER-STATUS    PON-PORT     SERIAL#
  2          0         UP          UP             pon0/0/3  414C5048E3BB8815(ALPHE3BB8815)

OcNOS#sh pon onu 2
  pon-port-name:    pon0/0/3
  olt-id:           0
  serial#:          414C5048E3BB8815(ALPHE3BB8815)
  onu-profile-name: FTTB_ALPHA_ONU
  admin-state:      UP
  oper-status:      UP
  uni-ports:        5
  tcont-maps:
    ALLOC-ID        TCONT-NAME           PON-PORT-NAME
    -------------------------------------------------
    1024            tcont-36             pon0/0/3
    1025            tcont-20             pon0/0/3
    1026            tcont-44             pon0/0/3
    1027            tcont-04             pon0/0/3
    1028            tcont-46             pon0/0/3
    1029            tcont-24             pon0/0/3
    1030            tcont-10             pon0/0/3
    1031            tcont-06             pon0/0/3
    1032            tcont-30             pon0/0/3
    1033            tcont-26             pon0/0/3
    1034            tcont-14             pon0/0/3
    1035            tcont-40             pon0/0/3
    1036            tcont-34             pon0/0/3
    1037            tcont-16             pon0/0/3
    1038            tcont-00             pon0/0/3
  gem-port-maps:
    GEM-PORT-ID     GEM-PORT-NAME        PON-PORT-NAME
    -------------------------------------------------
    1024            gem44                pon0/0/3
    1025            gem00                pon0/0/3
    1026            gem26                pon0/0/3
    1027            gem30                pon0/0/3
    1028            gem06                pon0/0/3
    1029            gem16                pon0/0/3
    1030            gem24                pon0/0/3
    1031            gem10                pon0/0/3
    1032            gem20                pon0/0/3
    1033            gem40                pon0/0/3
    1034            gem14                pon0/0/3
```

```
   1035        gem04                 pon0/0/3
   1036        gem46                 pon0/0/3
   1037        gem34                 pon0/0/3
   1038        gem36                 pon0/0/3
 onu-flow-list:
   FLOW-ID       FLOW-OPER-STATUS
   ----------------------------
   154           UP
   156           UP
   150           UP
 onu-uni-list:
   UNI-PORT-ID   ADMIN-STATUS   OPER-STATUS   CONFIG-IND
   ---------------------------------------------------
   0             UNLOCKED       ENABLED       Unknown
   1             UNLOCKED       ENABLED       Unknown
   2             UNLOCKED       ENABLED       100BASE-T full duplex
   3             UNLOCKED       ENABLED       1G Ethernet full duplex
   4             UNLOCKED       ENABLED       Unknown
   OcNOS#sh pon onu-profile FTTB_ALPHA_ONU
 ready-status: READY
 onu-tconts:
   T-CONT-NAME
   -----------
   tcont-36
   tcont-20
   tcont-44
   tcont-04
   tcont-46
   tcont-24
   tcont-10
   tcont-06
   tcont-30
   tcont-26
   tcont-14
   tcont-40
   tcont-34
   tcont-16
   tcont-00
 gem-ports:
   GEM-PORT-NAME       TCONT-NAME         UNI-PORT-ID   P-BITS   US-PQ   DS-PQ
 --------------------------------------------------------------------------
   gem44               tcont-44           4             4        4       4
   gem00               tcont-00           0             0        0       0
   gem26               tcont-26           2             6        6       6
   gem30               tcont-30           3             0        0       0
   gem06               tcont-06           0             6        6       6
   gem16               tcont-16           1             6        6       6
   gem24               tcont-24           2             4        4       4
   gem10               tcont-10           1             0        0       0
   gem20               tcont-20           2             0        0       0
   gem40               tcont-40           4             0        0       0
   gem14               tcont-14           1             4        4       4
   gem04               tcont-04           0             4        4       4
   gem46               tcont-46           4             6        6       6
   gem34               tcont-34           3             4        4       4
   gem36               tcont-36           3             6        6       6
```

```
  uni-logic-ports:
    UNI-LOGIC-PORT-ID
    ----------------
    4
    0
    2
    3
    1

OcNOS#sh pon translation-profile brief
  default_translation_profile
  cvlan120_p0
  cvlan120_p4
  cvlan120_p6

OcNOS#sh pon qos-profile default_qos_profile
  *CIR - Committed Information Rate
  *PIR - Peak Information Rate
  *PBS - Peak Burst Size

  dn-stream-rate-policer:
    CIR        CIR_UNITS      PIR        PIR_UNITS      PBS        PBS_UNITS
    ----------------------------------------------------------------
    15000      kbps           30000      kbps           30000      kbytes
  up-stream-rate-policer:
    CIR        CIR_UNITS      PIR        PIR_UNITS
    ---------------------------------------
    16000      kbps           48000      kbps

OcNOS#sh pon qos-profile 500Mbps
  *CIR - Committed Information Rate
  *PIR - Peak Information Rate
  *PBS - Peak Burst Size

  dn-stream-rate-policer:
    CIR        CIR_UNITS      PIR        PIR_UNITS      PBS        PBS_UNITS
    ----------------------------------------------------------------
    500        mbps           501        mbps           1          kbytes
  up-stream-rate-policer:
    CIR        CIR_UNITS      PIR        PIR_UNITS
    ---------------------------------------
    500        mbps           501        mbps

OcNOS#sh pon translation-profile default_translation_profile
  --------------------------------------------------------------------------
                            |          CLASSIFICATION          |      TREATMENT
  TRANS-PROFILE-NAME        | VLAN-TYPE       VLAN-ID  P-BITS | OPERATION    P-BITS
--------------------------------------------------------------------------
  default_translation_profile  UNTAGGED       0        0        NONE         0

OcNOS#show pon translation-profile cvlan120_p0
  --------------------------------------------------------------------------
                            |          CLASSIFICATION          |      TREATMENT
  TRANS-PROFILE-NAME        | VLAN-TYPE       VLAN-ID  P-BITS | OPERATION    P-BITS
  --------------------------------------------------------------------------
  cvlan120_p0                 TAGGED         120      0        REMOVE_VLAN  0
OcNOS#show pon translation-profile cvlan120_p4
```

```
    ----------------------------------------------------------------------
                               |         CLASSIFICATION         |       TREATMENT
    TRANS-PROFILE-NAME         | VLAN-TYPE    VLAN-ID  P-BITS | OPERATION    P-BITS
    ----------------------------------------------------------------------
    cvlan120_p4                  TAGGED        120       4        REMOVE_VLAN   4

OcNOS#sh pon translation-profile cvlan120_p6
    ----------------------------------------------------------------------
                               |         CLASSIFICATION         |       TREATMENT
    TRANS-PROFILE-NAME         | VLAN-TYPE    VLAN-ID  P-BITS | OPERATION    P-BITS
    ----------------------------------------------------------------------
    cvlan120_p6                  TAGGED        120       6        REMOVE_VLAN   6
OcNOS#show pon flow brief
    FLOW-ID       FLOW-OPER-STATUS
    ------------------------------
    154           UP
    156           UP
    150           UP

OcNOS#show pon flow 154
  flow-oper-status:     UP
  pon-port:              pon0/0/3
  uni-end:
    onu-id:             2
    uni-port-id:        2
    trans-profile-name: cvlan120_p4
    onu-vlan-tag:       154
  nni-end:
    olt-id:             0
    nni-port-name:      nni0/0/1
    olt-vlan-tag:       0
  qos:
    qos-profile-name:   500Mbps
  tcont:
    T-CONT-NAME
    -----------
    tcont-24
  gemport:
    GEM-PORT-NAME       UNI-PORT-ID   P-BITS   US-PQ   DS-PQ
    ------------------------------------------------------------
    gem24               2             4        4       4
  acl:
    id     priority direction  action      protocol remote-port   remote-ip
    ----------------------------------------------------------------------

OcNOS#sho pon flow 150
  flow-oper-status:     UP
  pon-port:              pon0/0/3
  uni-end:
    onu-id:             2
    uni-port-id:        2
    trans-profile-name: cvlan120_p0
    onu-vlan-tag:       150
 nni-end:
    olt-id:             0
    nni-port-name:      nni0/0/1
    olt-vlan-tag:       0
  qos:
    qos-profile-name:   500Mbps
```

```
  tcont:
    T-CONT-NAME
    -----------
    tcont-20
  gemport:
    GEM-PORT-NAME           UNI-PORT-ID   P-BITS   US-PQ   DS-PQ
    -------------------------------------------------------------
    gem20                   2             0        0       0
  acl:
    id     priority direction  action      protocol remote-port   remote-ip
    -------------------------------------------------------------------------

OcNOS#sho pon flow 156
  flow-oper-status:     UP
  pon-port:             pon0/0/3
  uni-end:
    onu-id:             2
    uni-port-id:        2
    trans-profile-name: cvlan120_p6
    onu-vlan-tag:       156
  nni-end:
    olt-id:             0
    nni-port-name:      nni0/0/1
    olt-vlan-tag:       0
  qos:
    qos-profile-name:   500Mbps
  tcont:
    T-CONT-NAME
    -----------
    tcont-26
  gemport:
    GEM-PORT-NAME           UNI-PORT-ID   P-BITS   US-PQ   DS-PQ
    -------------------------------------------------------------
    gem26                   2             6        6       6
  acl:
    id     priority direction  action      protocol remote-port   remote-ip
    -------------------------------------------------------------------------
```

ABOUT IP INFUSION

IP Infusion, a leader in disaggregated networking solutions, delivers enterprise and carrier-grade software solutions allowing network operators to reduce network costs, increase flexibility, and to deploy new features and services quickly. IP Infusion is headquartered in Santa Clara, Calif., and is a wholly owned and independently operated subsidiary of ACCESS CO., LTD. Additional information can be found at **http://www.ipinfusion.com**

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