

Application Centric Infrastructure: All about PolicyClassTag (pcTag)

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Introduction

This document describes the concept of Policy Class Tag(pcTag) / Class in Cisco Application Centric Infrastructure (ACI). The information in this document is based on software version 4.2(3n).

Prerequisites

To best understand the design presented in this document, the reader must have a basic working knowledge of Cisco ACI.

What is pcTag?

In simple words pcTag is a numeric ID used for internal representation of Endpoint Policy Group (epg) in ACI, also referred to as Source Class (sclass) or Destination Class (dclass). It is used for the classification of traffic and for Policy Enforcement (Contract Enforcement). When traffic ingress an ACI Leaf, based on the configured direction of policy enforcement (Default - Ingress) and locally available prefix information the ACI Leaf will classify and mark source and destination traffic into EPGs by assigning a pcTag value to it. The pcTag assigned to source epg is called SCLASS while the pcTag assigned to destination EPG is called DCLASS.

pcTag value ranges between 1 and 65535. It can be further be sub-divided into three categories.

System - These are internal system tag's from range 1-15. e.g 13 is for drop EPG and 15 is used for I3out with 0.0.0.0/0 subnet in EPG.

Global - By default the scope of pcTag is local to VRF(Virtual Routing and Forwarding). However, in case of inter VRF contracts pcTag must have a global scope and should be unique across api fabric. Range 16-16385 is reserved for global use.

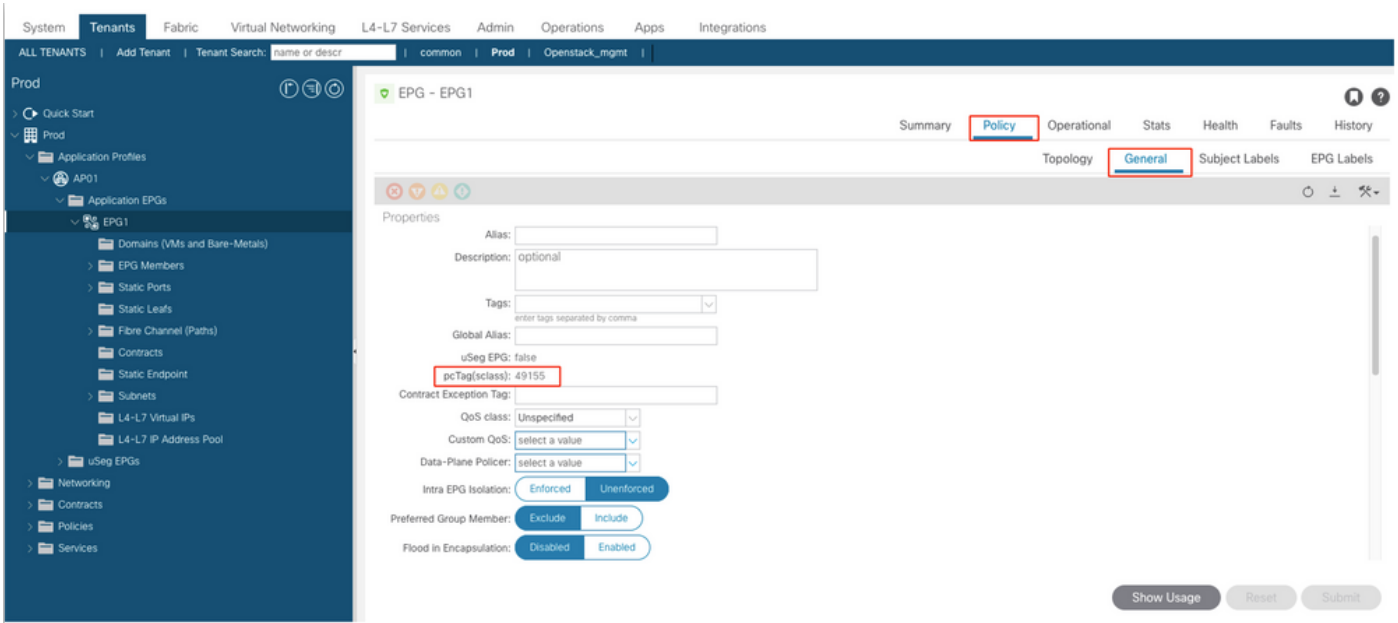
Local - The default scope of pcTag is local to VRF and may be reused across VRF's. Its value ranges from 16386-65535.

How to get pctag value of an EPG?

- Using Application Policy Infrastructure Controller(APIC) Graphical User Interface (GUI)

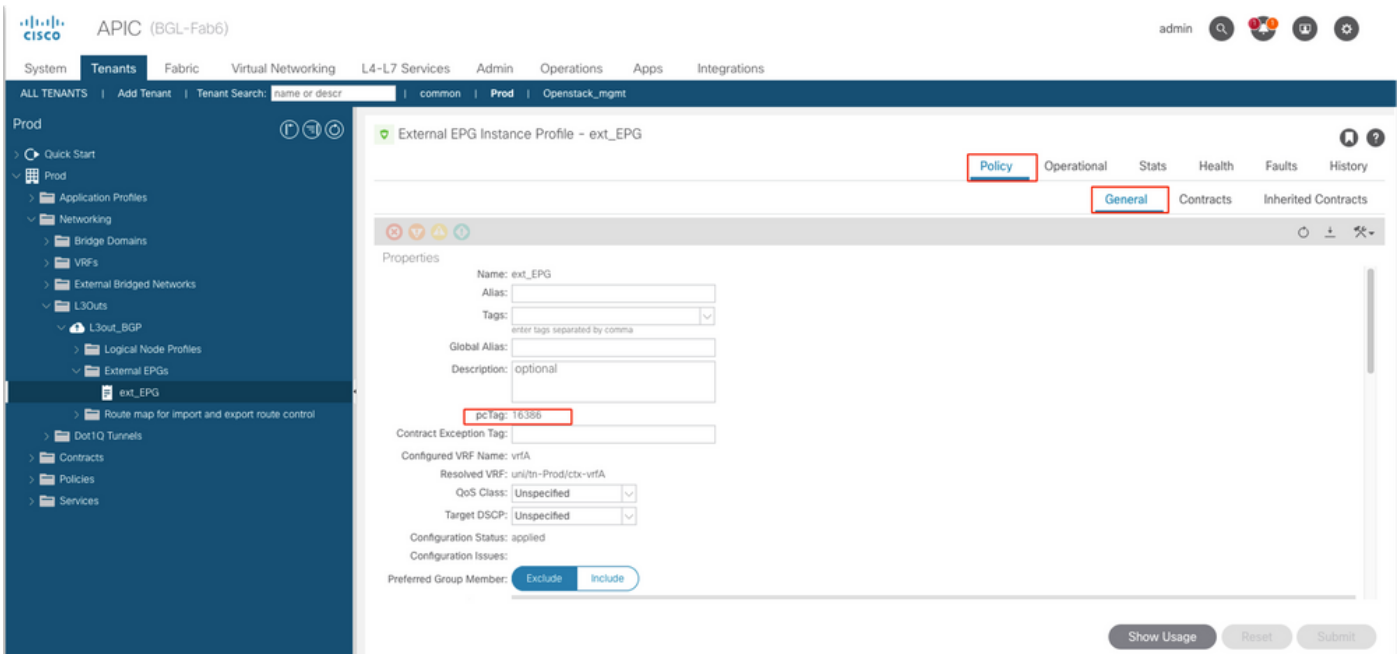
On the APIC GUI select the EPG for which you want to get the ptag and pcTag can be seen under Policy -> General

Tenants --> Application Profiles(AP) (Select the AP) --> Application EPGs (Select the EPG)--> Policy -->General



Similarly, for Layer 3 Out (L3Out) EPG, select L3out EPG and the pcTag can be found right under Policy -> General tab

Tenants --> Networking --> L3Outs-->Select the L3out --> External EPGs (Select the EPG) -->Policy -->General



• Using APIC Command Line Interface (CLI)

Using APIC CLI, pcTag of an EPG can be obtained by either using the given show command or by using Managed Object Query(MO Query).

```
apic# show epg EPG1 detail Application EPG Data: Tenant : Prod Application : AP01 AEPg : EPG1 BD : BD1 uSeg EPG : no Intra EPG Isolation : unenforced Proxy ARP : none Policy Tag : 49155 Vlan Domains : prod-phy-dom Consumed Contracts : default Provided Contracts : Denied Contracts : Qos Class : unspecified Tag List :
```

```
apic# moquery -c fvAEPg -f 'fv.AEPg.name=="EPG1"' | egrep "^name|^dn|^pcTag|^scope" name : EPG1 dn : uni/tn-Prod/ap-AP01/epg-EPG1 nameAlias : pcTag : 49155 scope : 2326533
```

Moquery to obtain pcTag value of a L3Out epg:

```
apic# moquery -c l3extInstP -f 'l3ext.InstP.name=="ext_EPG"' | egrep "^name|^dn|^pcTag" name :
ext_EPG dn : uni/tn-Prod/out-L3out_BGP/instP-ext_EPG nameAlias : pcTag : 16386
```

- **Using Leaf CLI**
- When the endpoint has been learned in a regular EPG, you can get the pcTag/SCLASS from EndPoint Manager(EPM).

```
bgl-aci05-leaf5# show system internal epm endpoint ip 192.168.10.10 MAC : 002c.c80a.7ca9 ::: Num
IPs : 1 IP# 0 : 192.168.10.10 ::: IP# 0 flags : ::: l3-sw-hit: No Vlan id : 74 ::: Vlan vnid :
13894 ::: VRF name : Prod:vrfA BD vnid : 15826927 ::: VRF vnid : 2326533 Phy If : 0x1a011000 :::
Tunnel If : 0 Interface : Ethernet1/18 Flags : 0x80000c04 ::: sclass : 49155 ::: Ref count : 5
<<<<<<<sclass EP Create Timestamp : 12/30/2020 15:45:21.722804 EP Update Timestamp : 12/30/2020
15:45:21.722804 EP Flags : local|IP|MAC|sclass| ::::
```

To get the pcTag value for L3Out EPG, the Policy Manager (Policy-mgr) prefix table is used:

In output, 16386 is the pcTag for subnet 10.20.20.0/24.

```
bgl-aci05-leaf5# vsh -c 'show system internal policy-mgr prefix' | egrep "Vrf-Vni|==|2326533"
Vrf-Vni VRF-Id Table-Id Table-State VRF-Name Addr Class Shared Remote Complete =====
=====
===== 2326533 5 0x5 Up Prod:vrfA 0.0.0.0/0 15 True True False 2326533 5 0x80000005 Up
Prod:vrfA ::/0 15 True True False 2326533 5 0x5 Up Prod:vrfA 10.20.20.0/24 16386 True True False
```

How to get the EPG name when you know pcTag value?

The simplest way to retrieve the EPG name from the APIC CLI when you know the pcTag is to use the below MO Query

For a regular EPG,

```
apic# moquery -c fvAEPg -f 'fv.AEPg.pcTag=="16387"' | egrep "name|^dn" name : EPG1 dn : uni/tn-
mgmt/ap-AP/epg-EPG1 nameAlias : scope : 2621440
```

For an L3out EPG:

```
apic# moquery -c l3extInstP -f 'l3ext.InstP.pcTag=="16386"' | egrep "name|^dn|^scope" name :
ext_EPG dn : uni/tn-Prod/out-L3out_BGP/instP-ext_EPG nameAlias : scope : 2326533
```

Note: There are chances when you can get multiple EPGs against one pcTag value, as the local pcTag has a scope local to the VRF. An additional filter with VRF segment ID can get you the exact match.

Rules to drive source pcTag and destination pcTag SCLASS/DCLASS of a flow

These rules can be used to determine the sclass and dclass of an intra-VRF flow and do a zoning-rule lookup

Sclass

SCLASS = Source Epg pcTag, if ingress EPG is a regular EPG.

Dclass

DCLASS= Destination EPG pcTag, if destination endpoint has learned on ingress

leaf.

DCLASS =1, if destination endpoint is not learned and we send the packet to fabric (Hardware Proxy or Flood). Policy Enforcement would be on destination Leaf.

DCLASS = 15, if hit is on 0.0.0.0/0 subnet under L3Out external EPG.

DCLASS = External EPG pcTag, when hit on a more specific or non-default subnet.

SCLASS = vrf pctag, if ingress into a L3Out under the 0.0.0.0/0 subnet in L3Out EPG.

SCLASS = Ext. EPG pcTag, if hit any other non-default subnet in L3Out external EPG.

Note: Subnet mentioned above is the subnet you configure under External EPG and not the subnet in a routing table.

Getting SCLASS/DCLASS using Embedded Logic Analysis Module (ELAM)

[ELAM](#) is one of the preferred tools to get source and destination pcTag values of a flow. In the ELAM, under "pkt rw vector", we can get the SCLASS and DCLASS of a flow using the given fields. The values will be in hexadecimal and need to be converted into decimal to get the EPG pcTag.

```
sug_lurw_vec.info.nsh_special.dclass: <val>
```

```
sug_lurw_vec.info.nsh_special.sclass: <val>
```

Example:

```
sug_lurw_vec.info.nsh_special.dclass: 0x8004 << dst epg pctag is 32772  
sug_lurw_vec.info.nsh_special.sclass: 0x8002. << src epg pctag is 32769
```

With the source and destination pcTag values, we can verify the Zoning Rules on ingress and egress Leaf Switches.

For more information on Zoning-Rules, [click here](#).