



# GFN SDN Controller User Manual

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## VPLS Service

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# 1. Acronyms

AD – Administrative Domain

AI – Artificial intelligence

ASIC – Application Specific Integrated Circuit

BGP – Border Gateway Protocol

BNG – Border Network Gateway

BRAS – Broadband Remote Access Server

BSS – Business Support System

CBS – Committed Bust Size

CEN -Carrier Ethernet Network

CG-NAT – Carrier Grade Network Address Translation

CIR – Committed Information Rate

CLI - Command Line Interface

CPU – Central Processing Unit

CRM – Customer Relationship Management

CRUD - Create, Read, Update, Delete

DB - Database

DC – Datacenter

DPI – Deep Packet Inspection

DPID – Data Path Identificator

E2E – End-to-End (services)

E-Access - OVC-based service with at least one UNI OVC End Point and one ENNI End Point

EBS – Excess Burst Size

EIR - Excess Information Rate

E-LAN – multipoint-to-multipoint EVC

E-Line – point-to-point EVC accordingly to MEF

EMS – Element Managements System

ENNI – External Network-to-Network Interface

EP-LAN – Ethernet Private LAN

EPL – Ethernet Private Line

E-Transit - OVC-based Carrier Ethernet service in which all OVC End Points are at ENNIs

E-Tree – point-to-multipoint EVC

ETSI – European Telecommunications Standards Institute

EVC – Ethernet Virtual Circuit

EVPL - Ethernet Virtual Private Line

IGMP – Internet Group Management Protocol

LAN – Local Area Network

LPM - Longest Prefix Match

MEF – Metro Ethernet Forum

MPLS – Multiprotocol Label Switching

NAT – Network Address Translation

NBI – North Bound Interface

NE – Network Element

NPU – Network Processing Unit

NVF – Network Functions Virtualization

NFVI – Network Functions Virtualization Infrastructure

OAM – Operations, Administration and Management

OF – OpenFlow protocol

OF-DPA – OpenFlow Data Plane Abstraction

ONF – Open Networking Foundation

OSS – Operation Support System

OVC – Operator Virtual Connection

OVS – Open vSwitch

PNE – Physical Network element

PNF – Physical Network Element

PoP – Point of Presence, see also Datacenter

QinQ – IEEE 802.1ad standard

QoS – Quality of Service

RFC – Request for Comments

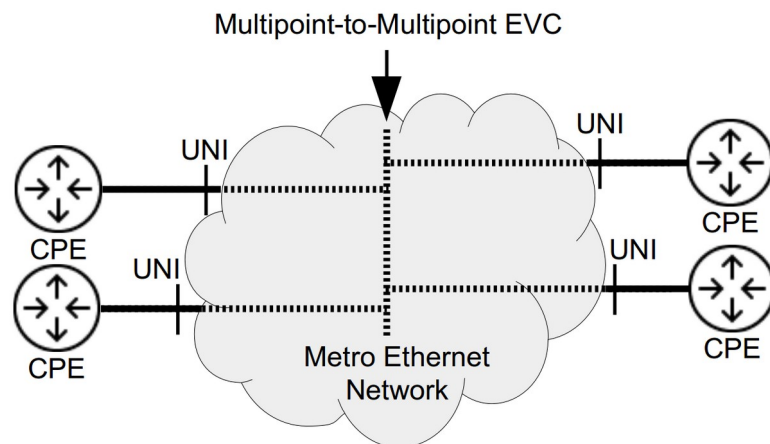
SBI – South Bound Interface

SDN – Software Defined Network

SLA – Service Level Agreement  
SQL – Structured Query Language  
SR – Segment Routing  
SRAM – Static Random Access Memory  
TAP – Terminal Access Point  
TCAM – Ternary Content Addressable Memory  
TE – Traffic Engineering  
T/T – Troubleshooting  
TTP – Table Type Pattern  
UDF - User-Defined Field  
UNI – User Network Interface  
VLAN – Virtual Local Area Network  
VIM – Virtual Infrastructure Manager  
VM – Virtual Machine  
VNE – Virtual Network Element  
VNF – Virtual Network Function  
VNFD – Virtual Network Function Descriptor  
VNFM – Virtual Network Function Manager  
VPLS – Virtual Private Area Network  
WAN – Wide Area Network  
ZTP – Zero Touch Provisioning

## 2. VPLS Service Review

VPLS service is Multipoint-to-Multipoint service which provides distributed Ethernet bridge domain with or without MAC learning (complementary service) between multiple end points in Metro Ethernet network. It is targeted for establishing B2B and B2C services and can be used either as a standalone service or as a part of triple-play. VPLS service corresponds to MEF 6.2 and MEF 10.3 E-LAN specifications. It can be used in both scenarios: port based EPLAN (Ethernet Private LAN) and VLAN based EVPLAN (Ethernet Virtual Private LAN).



VPLS service can span a lot of switches. VPLS is a fully protected service, thus its path will be automatically recalculated in case of link/node failure if possible.

### VPLS Service Attributes

VPLS service has following general attributes:

- VPLS ID
- Priority
- Path
- Active
- Description

VPLS ID is unique service identifier which is represented as string.

Priority attribute defines a place in queue for this exact VPLS as it will be recalculated in case of intermediate link/node failure.

Priority value directly impacts service convergence time. The value can be in a range from 0 to 7. The lower priority value is the faster service will be recalculated.

Path attribute defines an algorithm of calculating VPLS path in the network. Its value can be on of three types:

- NORMAL - normal path calculation on Dijkstra algorithm based on links speed, cost, latency and current utilization, targeted for Internet or 5G eMBB services
- LOW LATENCY - path is to be calculated on Dijkstra algorithm using links latency only, targeted for voice or 5G URLLC services
- BEST EFFORT - path is to be calculated on Dijkstra algorithm using current utilization only, targeted 5G mMTC services

Active attribute switches VPLS from active to stand by state and vice versa. VPLS in stand by mode is just defined inside SDN Controller only and not deployed into network.

Description is optional.

### VPLS End Points' Attributes

VPLS service has unlimited end points which have following attributes:

- DPID
- Port
- VLAN
- CIR
- CBS
- Description

DPID (Data Path ID) attribute identifies a device on which end point is defined.

Port attribute identifies device port on which end point is defined.

VLAN field is optional. It has to be set in range from 1 to 4095 for EVPL service and has to be left unset for EPL service.

CIR (Committed Information Rate) and CBS (Committed Burst Size) define a standard MEF bandwidth profile. If they are set then traffic shapers will be switched on on all end points of VPLS. If CIR and CBS are unset then shapers are not implemented.

Description is optional.



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**Note that even if traffic shapers are not needed in VPLS service it is recommended to set estimated non-zero value of CIR while set CBS to zero. This is important because CIR value even w/o shapers is used by Topology Manager of SDN Controller for calculation of links' utilization which is important for load balancing in ECMP Topology.**


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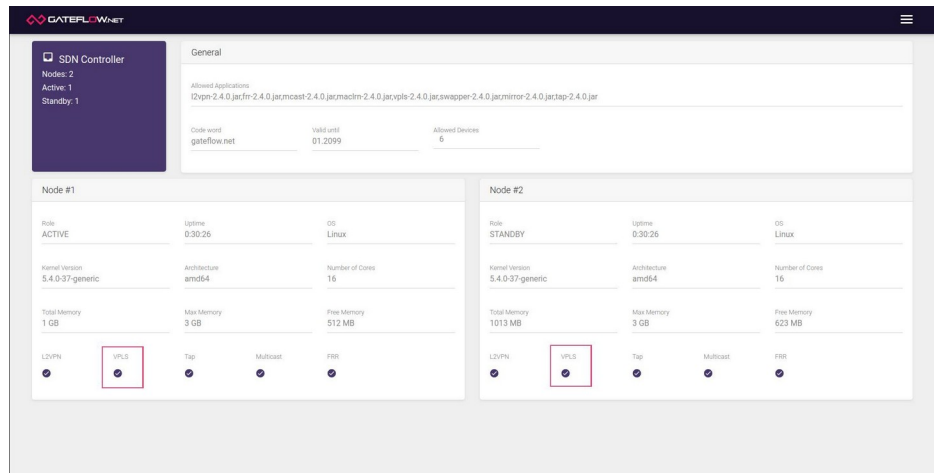


### 3. Prerequisites

To use VPLS service VPLS application and MAC learning application have to be running on SDN Controller. Check if VPLS application is running can be done in two ways:

- Via controller CLI by using command *app show*, VPLS application status has to be *running*.
- Via Web UI, by going to controllers page

(Menu→Inventory→Controllers), VPLS application should be marked with icon 



To check if MAC learning application is running one must use controller CLI command *app show* and check if MAC learning application status is *running*.

## 4. Operation of MAC Learning Service

MAC Learning service can be operated via controller CLI.

Available MAC learning CLI commands:

- mac show
- mac add
- mac delete

*mac show* will display list of known mac addresses and doesn't require any parameters.

*mac add* adds static MAC address and requires these parameters:

1. Mac address
2. IPv4 address
3. IPv6 address (optional)
4. Switch ID
5. Port ID
6. sVlan
7. cVlan (optional)

Example: *mac add 00:00:00:00:00:01 192.168.1.1*

*fd53:0c1f:d414:65af:: 00:00:00:00:00:00:00:00:01 1 120 240*

*mac delete* will delete MAC addresses and requires 1 of 3 parameters:

- -A

All MAC addresses

- -S

Static MAC addresses

- -D

Dynamic MAC addresses

Example: *mac delete -D* will delete all dynamically learned MAC addresses.

## 5. Operation of VPLS Service

There are three generic ways to operate L2 VPN service:

- CLI
- REST API
- Web UI

These interfaces are described in details below.

### CLI

CLI provides command for viewing existing VPLS services

- vpls show

For creating and updating VPLS service please use either Web UI or REST API.

### REST API

VPLS REST API implements a standard CRUD (Create, Read, Update, Delete) data manipulation paradigm. Any REST API call operates with data in JSON format. Below is an example of JSON file for REST API call to create VPLS service:

```
{
  "id": "vpls1",
  "active": false,
  "priority": 1,
  "path": "NORMAL",
  "endpoint": [
    {
      "dpid": "00:00:00:00:00:00:00:04",
      "port": 4,
      "vlan": 10,
      "cir": 100000,
      "cbs": 10000
    },
    {
      "dpid": "00:00:00:00:00:00:00:02",
      "port": 3,
      "vlan": 20,
      "cir": 150000,
      "cbs": 15000
    }
  ]
}
```

}

Below is an example of JSON file for REST API call to activate VPLS service:

```
{
  "serviceld": "vpls1",
  "action": "ACTIVATE"
}
```

Below is an example of JSON file for REST API call to deactivate VPLS service:

```
{
  "serviceld": "vpls1",
  "action": "DEACTIVATE"
}
```

## REST API Service URLs

There are several REST API URLs available for VPLS:

- Create VPLS services  
http://sdn-node:8084/vpls/create (Method - POST)
- Get all VPLS services  
http://sdn-node:8084/vpls/find (Method - GET)
- Get specific VPLS services  
http://sdn-node:8084/vpls/find/{id} (Method - GET)
- Activate/deactivate VPLS service  
http://sdn-node:8084/vpls/activate (Method - POST)
- Delete VPLS service  
http://sdn-node:8084/vpls/delete/{id} (Method - DELETE)

To send a REST API call on Linux command line utility “curl” can be used as shown below:

```

root@depo17:/scripts# clear
root@depo17:/scripts# curl -i -X POST -H "Content-Type: multipart/form-data" -F "data=@$JSON_PATH/l2vpn-create.json" http://GFN_REST1/l2vpn/config/load
HTTP/1.1 200 Continue
HTTP/1.1 200 OK
Content-Length: 10
Content-Type: application/json; charset=UTF-8
Date: Thu, 21 Nov 2019 00:23:50 GMT
Accept-Range: bytes
Server: Restlet-Framework/2.3.2
Vary: Accept-Charset, Accept-Encoding, Accept-Language, Accept
Access-Control-Expose-Headers: Authorization, Link
Connection: keep-alive
{"message":"Done"}root@depo17:/scripts#
root@depo17:/scripts#

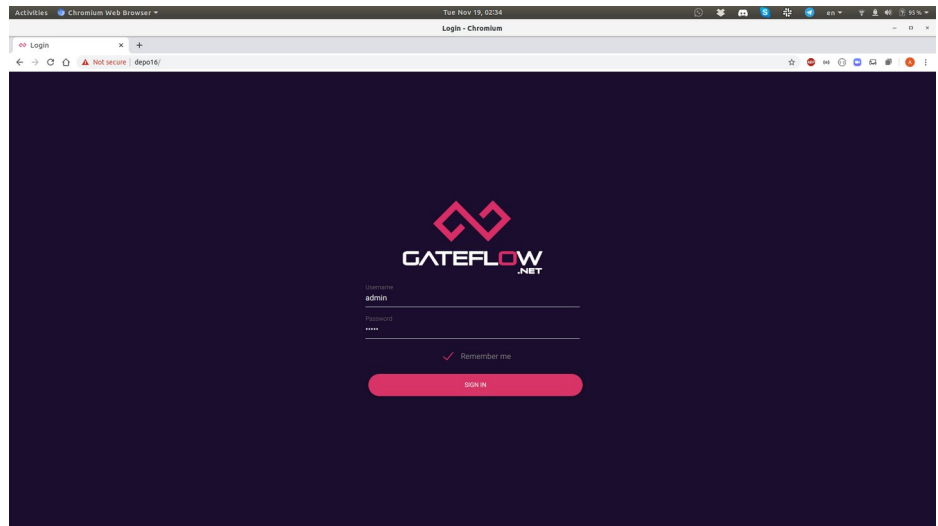
```




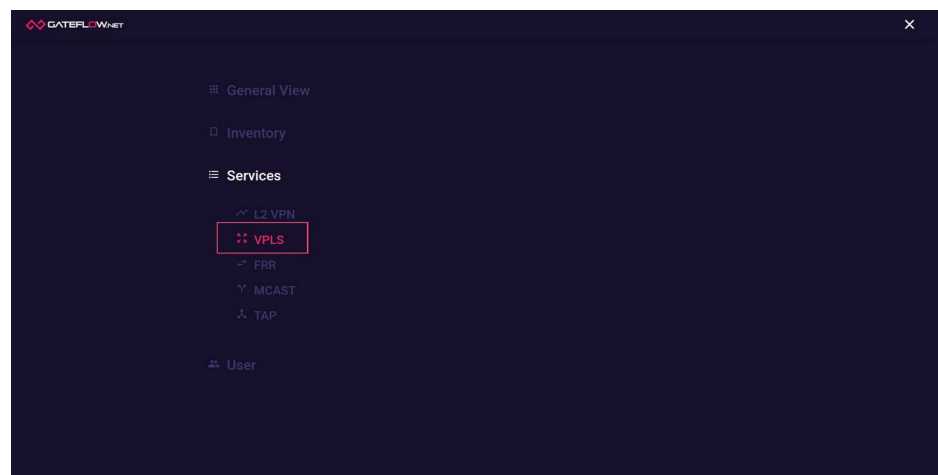
**For detailed description of all VPLS service JSON file fields format and constraints please refer to GFN SDN Controller Admin Manual.**

## Web UI

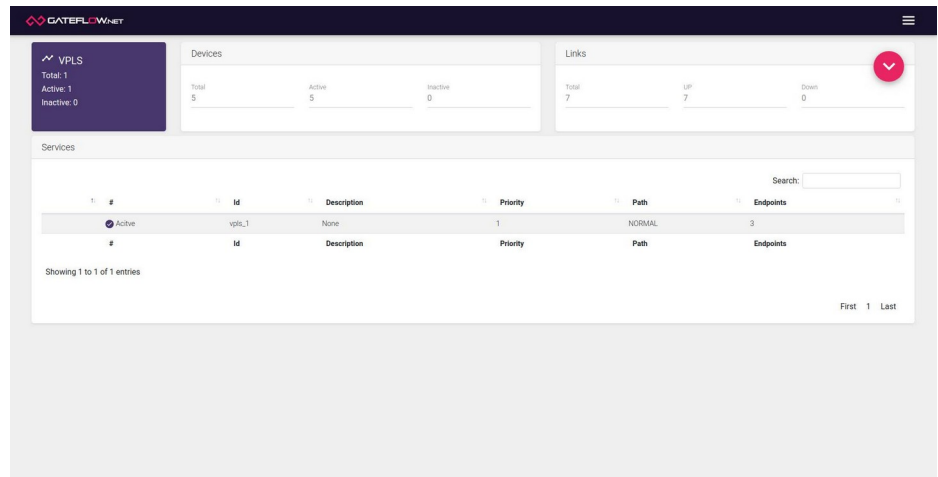
To access VPLS management graphic interface via web browser one has to login to GFN SDN Controller Web UI first as shown in the example below:



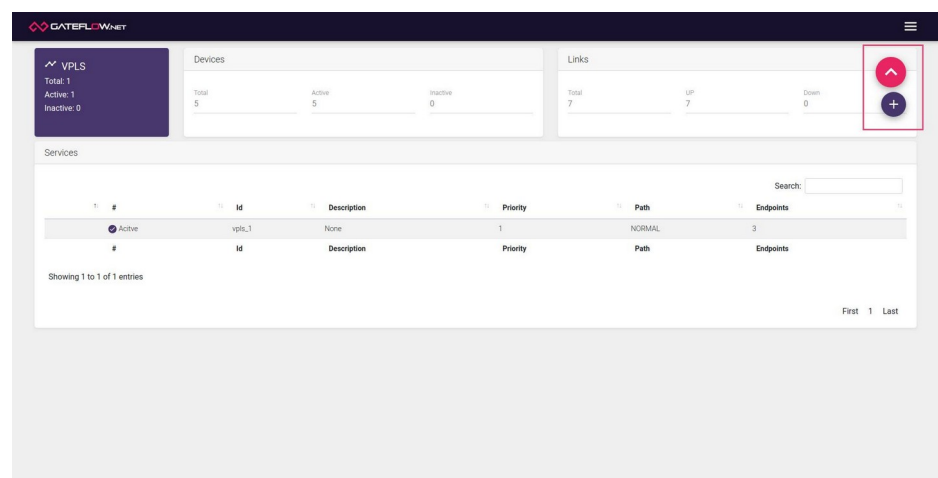
After logging in one has to open a full screen menu using icon  at the top bar and choose drop-down Menu->Services->VPLS section as shown below:



A VPLS services list will appear. This list contains brief information about every existing VPLS service. Clicking on a service in the list will open service details page for corresponding service.

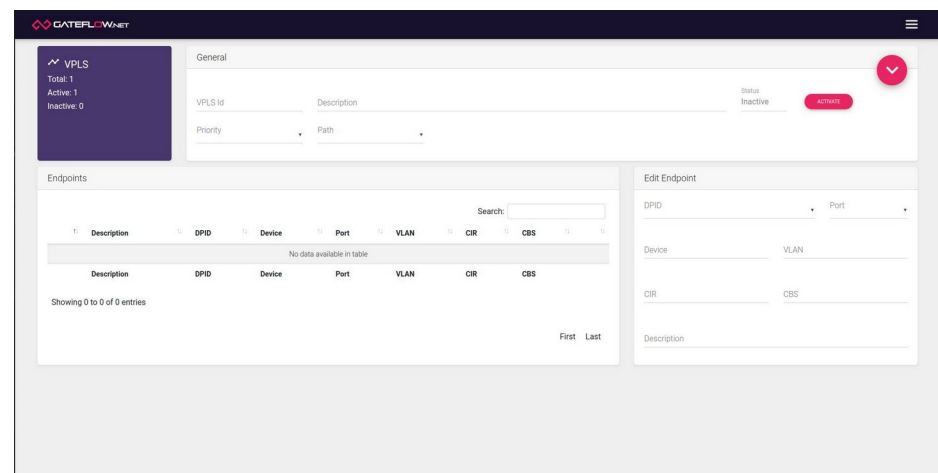


One can open VPLS submenu by clicking the floating button in the top-right corner of the screen.



To create a new VPLS service press the corresponding button in the submenu and the creation form will appear.

*Note: creating, editing and deleting service functions are only available for users with admin privileges.*



Here one can fill in general parameters for the service and create endpoints by filling in “Edit Endpoint” form and pressing “Add endpoint” button in submenu (opened by clicking the floating

button). Created end points will be listed in the “Endpoints” list and can be deleted by pressing “Delete” button on the corresponding end point.

To create service press “Save” button in submenu. If service was created successfully one will be redirected to new service details page. If something went wrong – a floating error message will appear.

Currently existing services can be activated/deactivated. To activate/deactivate service press “Edit” button in the submenu, then press “activate/deactivate” button in the “General” card and press “Save” in the submenu.

To delete service press “Edit” button in the submenu, then press “Delete” button in the submenu. Service will be deleted and you will be redirected to VPLS services list.

Pressing “Back to List” button in the submenu at any point will return one to VPLS services list.



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**All changes must be saved by pressing “Save” button in the submenu beforehand, otherwise they will be lost.**

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