

# PICOS Routing and Switching Configuration Guide

Pica8 PicOS supports Layer 2 switching protocols, including: STP, RSTP, MSTP, MAC learning, and Q-in-Q. PicOS also supports several Layer 3 protocols, including: static routing, RIPv2, OSPF, IGMP, PIM-SM, and IPv6. This guide provides instructions and examples for configuring switches and controllers. Intended for system administrators, this guide assumes a working knowledge of Layer 2 and Layer 3 protocols.

PicOS can run in 2 different modes of operation:

- **Open vSwitch (OVS) Mode:** In this mode, PicOS is dedicated and optimized for OpenFlow applications.
- **Layer 2/Layer 3 (L2/L3) Mode:** In this mode, PicOS can run switching and routing protocols, as well as OpenFlow applications.

In OVS mode, L2/L3 daemons are not running, and the system is fully dedicated to OpenFlow and OVS. In L2/L3 mode, L2/L3 daemons are running, and OVS can also be used if [CrossFlow](#) is activated.

This chapter assumes that user is running PicOS L2/L3 mode. Please see [PICOS Mode Selection](#) to learn how to switch between L2/L3 and OVS modes.



On N3048EP-ON, N3048ET-ON, N1148T-ON and N3132PX switches, run "copy running-config startup-config" command when set L2 / L3 CLI commands. Otherwise, the L2 / L3 configuration will be lost after PicOS reboot. For detail, please refer to [Configuration Saving Guide](#).

## Supported Features

## Unsupported Functions on N1148T-ON

## Collection of Feature Specification of Different Platforms

### Command-Line Interface

- From Linux Shell to L2/L3 Shell
- Operation Mode and Configuration Mode
- Displaying the Current Configuration
- Display Setting Configuration
- Rolling Back a Configuration
- Managing Configuration Files
- Saving and Loading Configuration Files
- Commit Confirmed
- Commit Check
- Commit Failed and Exit Discard
- Configuring a Command Alias
- Configure L2/L3 from Linux Shell
- Bash Linux Shell
- PicOS Upgrade and Configuration Change
- Set CLI
- CLI Configuration
- Configuring Multi-window Command Configuration Display on The User Terminal
- Configuration Saving Guide

### System Administration

- Configuring a User Account
- AAA Configuration Guide
  - Introduction
  - Configuration Notes of AAA
  - TACACS+ Configuration
  - RADIUS Configuration
  - Local Authentication Configuration
  - Sample configuration file on the AAA server
- Configuring SSH Parameters
- Configuring the Log-in ACL
- NAC Configuration Guide
  - Principle of NAC
  - Configuration Notes of NAC
  - Configuring NAC
  - Configuration Example of NAC
    - Example for Configuring 802.1X Authentication
    - Example for Configuring MAB Authentication
    - Example for Configuring CWA Authentication
    - Example for Configuring Multiple Authentication Modes
  - Typical Configuration of NAC
    - Example for Configuring NAC (PacketFence as the Authentication Server)
    - Solution Document Download
  - References
- Configuring NTP and the Time Zone Parameter
- Configuring PTP
- Configuring the linux-config-unreliable
- Configuring IPFIX

- Configuring sFlow
- Configuring the Syslog Log Level
- Configuring the Syslog Disk and Syslog Host
- Displaying System Information
- IPv6 Management Support
- Configuring NETCONF
- SNMP Configuration
  - Configuring SNMPv2
  - Configuring SNMPv3
  - PICA8 Private MIB
    - pica\_private\_mib.my
    - pica\_private\_trap\_mib.my
  - PICA8 Public MIB
- PoE Configuration Guide
  - Configuring PoE
  - PoE over LLDP Power Negotiation
  - UPoE
- Configuring USB Disable
- Configuring CPU Usage Alarm Threshold
- Configuring MAC Usage Alarm Threshold
- Configuring Mirroring
- Configuring Mirroring Guide
- Example for Configuring Inband Management Interface on N1148T-ON

## Ethernet Ports Management Configuration

- Physical Ethernet Port Configuration
- Interface Rate Configuration
  - Introduction of Interface Rate
  - Configuring the Interface Rate
    - Configuring the Force Rate of an Interface
    - Configuring the Auto-Negotiation Mode
- Port Security Configuration
- CDR Function Configuration
- Time Domain Reflectometry (TDR)
- Configuring Port Breakout and Merge
- Configuring Port Mapping On S4148 Series Switch
- 10G-Base-KR Interface Configuration

## Layer 2 Switching Configuration

- Static MAC entries and Dynamic MAC Address Learning
- Cut-Through Switching Method
- MLAG Configuration
  - Principle of MLAG
  - Configuration Notes and Constraints
  - Configuring MLAG
  - Configuration Example of MLAG
    - Example for Configuring a Basic MLAG
    - Example for Configuring MLAG with Active-Active-VRRP
    - Example for Configuring MLAG with DHCP Snooping
    - Example for Configuring MLAG with IGMP Snooping
    - Example for Configuring MLAG with Rapid PVST+
    - Example for Configuring MLAG with VXLAN
- VLAN Port Configuration
- Q-in-Q Basic Port Configuration
- Voice VLAN Configuration Guide
  - Principle of Voice VLAN
  - Configuration Notes of Voice VLAN
  - Configuring Voice VLAN
  - Configuration Example of Voice VLAN
- VXLAN Configuration
  - VXLAN Configuration Guide
  - VXLAN Base Configuration Example
  - VXLAN ECMP Configuration
  - OVSDB VTEP Configuration
    - Configuring an OVSDB VTEP
    - OVSDB VTEP with Midonet Configuration
    - OVSDB VTEP with NSX Configuration
    - OVSDB VTEP with vtep-ctl Configuration Examples
- Link Aggregation Configuration
  - Static Link Aggregation (LAG) Configuration
  - Link Aggregation Control Protocol (LACP) Configuration
  - LAG Hashing Configuration
    - LAG Hashing Configuration and Example
    - LAG Hash Mapping
    - Resilient LAG Hashing Configuration and Example
- Symmetric Hash for LAG Configuration Example
- DHCP Configuration
  - Configuring DHCP Relay

- Configuring DHCP Snooping
- Configuring DHCP Relay and DHCP Snooping together
- LLDP Configuration (Link Layer Discovery Protocol)
- LLDP MED Configuration
- MSTP Configuration
- MSTP Configuration Example
- Rapid PVST+ Configuration
- Rapid PVST+ Configuration Example
- BPDU Tunneling Configuration
- UDLD Configuration
- LFS Configuration
- Storm Control in Ethernet Port Configuration
- IGMP Snooping Configuration Guide
  - Introduction to IGMP Snooping
  - Configuring IGMP Snooping
  - Configuration Example of IGMP Snooping
  - RFC List

## Layer 3 Unicast Routing Configuration

- Layer 3 VLAN Interface Configuration
- ARP Configuration
  - Configuring ARP
  - Dynamic ARP Inspection
  - Flushing ARP and the Neighbor Table
- VRF Configuration Guide
  - Introduction to VRF
  - Configuration Notes of VRF
  - Configuring VRF
  - Example for Configuring Basic VRF
- Configuring IP Routing
- Default Administrative Distance Values
- Static Routing Configuration
- Static Routing Configuration Example
- RIPv2 Routing Protocol Configuration
- RIPv2 Routing Configuration Example
- OSPF (Open Shortest Path First)
  - OSPF Overview
  - Basic OSPF Configuration Tasks
  - Basic OSPF Configuration Example
  - OSPFv3 Routing Protocol Configuration
  - OSPF Configuration Example: NSSA Stub Normal
  - OSPF Stub Area NSSA Summary
  - OSPF Virtual Link Configuration Guide
  - OSPF Area Range Configuration Guide
  - Importing an External Route into an OSPF Area
- BFD Protocol Configuration
- BFD Basic Configuration Example
- ECMP (Equal-Cost Multipath Routing) Configuration
- Symmetric Hash for ECMP Configuration Example
- VRRP Configuration
  - Principle of VRRP
  - Configuration Notes of VRRP
  - Configuring Standard VRRP
  - Configuring Active-Active VRRP
  - VRRP Configuration Example
    - Example for Configuring Standard VRRPv3 for IPv4
    - Example for Configuring Active-Active VRRPv3 for IPv4
    - Example for Configuring Active-Active VRRPv3 for IPv6
- IPv6 Neighbor Configuration
- IPv6 Static Routing Configuration
- IPv4/IPv6 BGP Configuration
  - IPv4 BGP configuration
    - BGP Configuration Guide
    - BGP Basic Configuration Example
    - BGP Route Reflector Configuration Example
    - BGP Confederation Configuration Example
    - BGP Load Balancing Configuration Example
  - IPv6 BGP Configuration
    - IPv6 BGP Introduction
    - Building Peering Sessions
      - EBGP Peering
      - IBGP Peering
    - Establish BGP Peer Use 4-byte-AS-Number
    - Sources of Routing Updates
      - Injecting Information Dynamically into BGP
      - Injecting Information Statically into BGP
    - BGP Attributes
      - The NEXT\_HOP Attribute
      - The AS\_PATH Attribute

- The LOCAL\_PREF Attribute
  - The MULTI\_EXIT\_DISC Attribute
  - The COMMUNITY Attribute
- BGP-4 Aggregation
- Synchronization
- Controlling Large-Scale Autonomous System
  - Confederations
  - Route Reflectors
- Redundancy and Load Balancing
- Designing Stable Internets
- Labeled BGP
  - Labeled BGP Support
  - Configuration Example for Labeled Support
    - IPv4 Labeled BGP Configuration
    - IPv6 Labeled-BGP Configuration
  - Debugging CLI for Labeled-BGP
- IPv6 RA Guard Configuration

## IP Multicast Routing Configuration

- IGMP Configuration
- PIM Configuration Guide
  - Introduction of PIM
  - Configuring PIM-SM
  - Configuration Example of PIM
    - Example for Configuring Basic PIM-SM
    - Example for Configuring PIM-SM
    - Example for Configuring SPT Switchover in PIM-SM Domain
    - Example for Configuring PIM-SSM
  - RFC List of PIM

## ACL Configuration

- Configuring Basic ACL

## QoS Configuration

- Weighted Random Early Detection
  - WRED Overview
  - WRED Configuration Tasks
  - WRED Configuration Example
- QoS Principle
- SP Configuration Example
- WRR Configuration Example
- WFQ Configuration Example
- QoS Configuration Example
  - Configuring Classifier-based QoS
  - Configuring ACL-based QoS
- PFC Configuration Example
- Buffer Management
- ACL-based Traffic Policer
- CoPP Configuration Guide
  - Principle
  - Default Settings for CoPP
  - CoPP Configuration
    - Configuration Notes
    - Configuring CoPP
    - Configuration Example
- Queue-based Rate Limiting
- Interface-based Rate Limiting
  - Configuring Egress Interface-based Rate Limiting
  - Configuring Ingress Interface-based Rate Limiting

## OpenFlow in Crossflow Mode

- Crossflow Mode Introduction
- CrossFlow Mode Known Limitations
- Crossflow Basic Configuration
- Configuration Example1 in Crossflow Mode
- Configuration Example2 in Crossflow Mode
- Example for Configuring STM Resource Allocation