

## Junos® OS

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# Services Interfaces Overview for Routing Devices

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Juniper Networks, Inc.  
1133 Innovation Way  
Sunnyvale, California 94089  
USA  
408-745-2000  
[www.juniper.net](http://www.juniper.net)

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# About This Guide

Use this guide to learn what a service interface is, what service interface cards are available, and how to configure a service interface.

# 1

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## Overview

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# Understanding Services PICs

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## Services PICs-Overview

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Interfaces used in router networks can be broadly classified into two:

- Networking interfaces, such as Ethernet and SONET interfaces, that primarily provide traffic connectivity. For more information on these interfaces, see the [Interfaces Fundamentals for Routing Devices](#) guide.
- Services interfaces, such as Adaptive Services interfaces and MultiServices interfaces, that provide specific capabilities for manipulating traffic before it is delivered to its destination.

For information about which platforms support Adaptive Services and MultiServices PICs and their features, see ["Enabling Service Packages" on page 12](#).

For information about PIC support on a specific Juniper Networks M Series Multiservice Edge Router or T Series Core Router, see the appropriate *PIC Guide* for the platform.

Services interfaces enable you to add services to your network incrementally. Junos OS supports the following services interfaces:

## Adaptive Services and Multiservices PICs

Adaptive Services [AS] PICs and Multiservices PICs enable you to perform multiple services on the same PIC by configuring a set of services and applications. The AS and Multiservices PICs offer a range of services that you can configure in one or more service sets. The following are some of the services you can configure on Adaptive services or multiservices interfaces:

- Class-of-service
- Intrusion detection service (IDS)
- IP Security (IPsec)
- Layer 2 tunneling protocols
- Monitoring services
- Network Address Translation (NAT)
- Stateful firewalls
- Voice services

For more information about these services, see *Adaptive Services and Multiservices Interfaces Overview*.



**NOTE:** On Juniper Networks MX Series 5G Universal Routing Platforms, the Multiservices DPC provides essentially the same capabilities as the Multiservices PIC. The interfaces on both platforms are configured in the same way.

## Encryption Services (ES) PIC

ES PIC provides a security suite for the IP version 4 (IPv4) and IP version 6 (IPv6) network layers. The suite provides functionality such as authentication of origin, data integrity, confidentiality, replay protection, and nonrepudiation of source. It also defines mechanisms for key generation and exchange, management of security associations, and support for digital certificates. For more information about encryption interfaces, see *Configuring Encryption Interfaces*.

## Multilink Services and Link Services PICs

Multilink Services and Link Services PICs enable you to split, recombine, and sequence datagrams across multiple logical data links. The goal of multilink operation is to coordinate multiple independent links between a fixed pair of systems, providing a virtual link with greater bandwidth than any of the members. The Junos OS supports two services PICs based on the Multilink Protocol: the Multilink Services PIC and the Link Services PIC.

For more information about multilink and link services interfaces, see [Link and Multilink Services Interfaces User Guide for Routing Devices](#).

## Monitoring Services PICs

Monitoring Services PICs enable you to monitor traffic flow and export the monitored traffic. Monitoring traffic allows you to perform the following tasks:

- Gather and export detailed information about IPv4 traffic flows between source and destination nodes in your network.
- Sample all incoming IPv4 traffic on the monitoring interface and present the data in cflowd record format.
- Perform discard accounting on an incoming traffic flow.
- Encrypt or tunnel outgoing cflowd records, intercepted IPv4 traffic, or both.
- Direct filtered traffic to different packet analyzers and present the data in its original format.

For more information about flow monitoring interfaces, see [Monitoring, Sampling, and Collection Services Interfaces User Guide](#).

## Tunnel Services PIC

Tunnel Services PIC provides a private, secure path through an otherwise public network by encapsulating arbitrary packets inside a transport protocol. Tunnels connect discontinuous subnetworks and enable encryption interfaces, virtual private networks (VPNs), and MPLS.

For more information about tunnel interfaces, see [Tunnel Services Overview](#).

## Multiservices MIC and Multiservices MPC

The Multiservices Modular Interfaces Card (MS-MIC) and the Multiservices Modular PIC Concentrator (MS-MPC), introduced in Junos OS Release 13.2, provide improved scaling and high performance. The MS-MIC and MS-MPC have enhanced memory (16 GB for MS-MIC, 32 GB per NPU of MS-MPC) and processing capabilities.

The services interfaces on MS-MPC and MS-MIC are identified in the configuration with an `ms-` prefix (for example, `ms-1/2/1`).

The following services packages come preinstalled and preconfigured on MS-MICs and MS-MPCs in Junos OS Release 13.2:

- Junos Traffic Vision (formerly referred to as Jflow/Flow Monitoring)
- Junos Address Aware (formerly referred to as NAT features)
- Junos VPN Site Secure (formerly referred to as IPsec features)
- Junos Network Secure (formerly referred to as the Stateful Firewall feature)

For information about MS-MIC and MS-MPC, see ["Multiservices MIC and Multiservices MPC \(MS-MIC and MS-MPC\) Overview" on page 5](#).

## SEE ALSO

[Packet Flow Through the Adaptive Services or Multiservices PIC](#)

[Enabling Service Packages | 12](#)

[Services Configuration Procedure | 18](#)

## Multiservices MIC and Multiservices MPC (MS-MIC and MS-MPC) Overview

Juniper Networks MX Series routers supports the Multiservices Modular Interfaces Card (MS-MIC) and the Multiservices Modular PIC Concentrator (MS-MPC) that provide improved scaling and high performance.

The services interfaces on MS-MPC and MS-MIC are identified in the configuration with an `ms-` prefix (for example, `ms-1/2/1`). The following services packages come preinstalled and preconfigured on MS-MICs and MS-MPCs:

- Junos Traffic Vision (formerly referred to as Jflow)
- Junos Address Aware (formerly referred to as NAT features)
- Junos VPN Site Secure (formerly referred to as IPsec features)
- Junos Network Secure (formerly referred to as the Stateful Firewall feature)
- Junos Services Crypto Base PIC Package

- Junos Services Application Level Gateways



**NOTE:** You can check the default packages on an MS-MIC or MS-MPC by executing the `show extension-provider system packages interface ms-interface` operational mode command.

The MS-MPC on your MX Series router supports a maximum of two million active routes only. If the number of active routes exceeds this threshold, the heap memory used by the Packet Forwarding Engine is exhausted. As a result, the MS-MPC becomes unresponsive.

The MS-MIC supports the following Layer 3 services such as stateful firewall, NAT, IPsec, active flow monitoring, RPM, and *graceful Routing Engine switchover* (GRES). For more information on the supported features, see [Protocols and Applications Supported by the MS-MIC and MS-MPC](#).

The MS-MIC and MS-MPC also support the captive portal content delivery (HTTP redirect) service package when configured for installation using the `set chassis` operational mode command.



**NOTE:**

- Starting with Junos OS Release 14.2, the MX104 router supports two MS-MICs. Also, *graceful Routing Engine switchover* (GRES) is not supported for MS-MIC on the MX104 router.
- Starting from Junos OS Release 18.1R1, Junos Node Slicing supports assignment of MS-MICs and MS-MPCs to guest network functions (GNFs), or partitions created on a router by using [Junos Node Slicing](#).
- Starting with Junos OS Release 19.2R1, the MX2020 router supports 15 MS-MPC cards.

[Table 1 on page 6](#) lists the platforms on which the MS-MIC and MS-MPC are supported.

**Table 1: MX Series Routers That Support MS-MIC and MS-MPC**

	MX5	MX10	MX40	MX80	MX104	MX240	MX480	MX960	MX2008	MX2010	MX2020
MS-MIC	Yes	Yes	Yes	Yes	Yes  <b>NOTE:</b> MX104 is first supported in Junos OS	Yes	Yes	Yes	Yes	Yes	Yes

**Table 1: MX Series Routers That Support MS-MIC and MS-MPC (Continued)**

	MX5	MX10	MX40	MX80	MX104	MX240	MX480	MX960	MX2008	MX2010	MX2020
					Release 13.3R2.					NOTE: Only Junos Traffic Vision is supported.	
<b>MS-MPC</b>	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

You can install an MS-MIC on one of the following line cards:

- MPC-Type1
- MPC-Type2
- MPC-Type3

For information about MS-MIC, MS-MPC, and MS-DPC support on a specific MX Series router, see the [MX Series 5G Universal Routing Platform Interface Module Reference](#).

For information about services supported on Juniper Networks SRX Series Firewalls, see [Feature Explorer](#).

## SEE ALSO

### [Multiservices MIC](#)

*Example: Configuring Junos VPN Site Secure on MS-MIC and MS-MPC*

*Example: Configuring Flow Monitoring on an MX Series Router with MS-MIC and MS-MPC*

[Protocols and Applications Supported by the MS-MIC and MS-MPC](#)

## Change History Table

Feature support is determined by the platform and release you are using. Use [Feature Explorer](#) to determine if a feature is supported on your platform.

Release	Description
19.2R1	Starting with Junos OS Release 19.2R1, the MX2020 router supports 15 MS-MPC cards.
18.1R1	Starting from Junos OS Release 18.1R1, Junos Node Slicing supports assignment of MS-MICs and MS-MPCs to guest network functions (GNFs), or partitions created on a router by using <a href="#">Junos Node Slicing</a> .
14.2	Starting with Junos OS Release 14.2, the MX104 router supports two MS-MICs.
14.1	MX2010 is first supported in Junos OS Release 14.1.
14.1	MX2020 is first supported in Junos OS Release 14.1.
13.3R2	MX104 is first supported in Junos OS Release 13.3R2.

# 2

CHAPTER

## Configuration Overview

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# Configuring Services Interfaces

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## Services Interface Naming Overview

Each interface has an interface name, which specifies the media type, the slot the FPC is located in, the location on the FPC that the PIC is installed in, and the PIC port. The interface name uniquely identifies an individual network connector in the system. You use the interface name when configuring interfaces and when enabling various functions and properties, such as routing protocols, on individual interfaces. The system uses the interface name when displaying information about the interface, for example, in the `show interfaces` command.

The interface name is represented by a physical part, a logical part, and a channel part in the following format:

```
physical<:channel>.logical
```

The channel part of the name is optional for all interfaces except channelized DS3, E1, OC12, and STM1 interfaces.

The physical part of an interface name identifies the physical device, which corresponds to a single physical network connector. This part of the interface name has the following format:

```
type- fpc/pic/port
```

*type* is the media type, which identifies the network device. For service interfaces, it can be one of the following:

- **ams**—Aggregated multiservices (AMS) interface. An AMS interface is a bundle of services interfaces that can function as a single interface. An AMS interface is denoted as `amsN` in the configuration, where `N` is a unique number that identifies an AMS interface (for example, `ams0`). The member interfaces in an AMS interface are identified in the configuration with an `mams-` prefix (for example, `mams-1/2/0`).
- **cp**—Flow collector interface.
- **es**—Encryption interface.
- **gr**—Generic routing encapsulation tunnel interface.
- **gre**—This interface is internally generated and not configurable.
- **ip**—IP-over-IP encapsulation tunnel interface.
- **ipip**—This interface is internally generated and not configurable.
- **ls**—Link services interface.
- **lsq**—Link services intelligent queuing (IQ) interface; also used for voice services.
- **mams**—Member interface in an AMS interface.
- **m1**—Multilink interface.
- **mo**—Monitoring services interface. The *logical interface* `mo-fpc/pic/port.16383` is an internally generated, nonconfigurable interface for router control traffic.
- **ms**—Multiservices interfaces on multiservices modular interfaces card (MS-MIC) and multiservices modular port concentrators (MS-MPC).
- **mt**—Multicast tunnel interface. This interface is automatically generated, but you can configure properties on it if needed.
- **mtun**—This interface is internally generated and not configurable.
- **rlsq**—Redundancy LSQ interface.
- **rsp**—Redundancy adaptive services interface.
- **si**—Services inline interface, configured on MX3D Series routers only.
- **sp**—Adaptive services interface. The logical interface `sp-fpc/pic/port.16383` is an internally generated, nonconfigurable interface for router control traffic.

- `tap`—This interface is internally generated and not configurable.
- `vt`—Virtual loopback tunnel interface.

## SEE ALSO

*Understanding Aggregated Multiservices Interfaces*

*Examples: Configuring Services Interfaces*

## Enabling Service Packages

### IN THIS SECTION

- [Layer 2 Service Package Capabilities and Interfaces | 17](#)

For AS PICs, Multiservices PICs, Multiservices DPCs, and the internal Adaptive Services Module (ASM) in the M7i router, there are two service packages: Layer 2 and Layer 3. Both service packages are supported on all adaptive services interfaces, but you can enable only one service package per PIC, with the exception of a combined package supported on the ASM. On a single router, you can enable both service packages by installing two or more PICs on the platform.



**NOTE:** Graceful Routing Engine switchover (GRES) is automatically enabled on all services PICs and DPCs except the ES PIC. It is supported on all M Series, MX Series, and T Series routers except for TX Matrix routers. Layer 3 services should retain state after switchover, but Layer 2 services will restart. For IPsec services, Internet Key Exchange (IKE) negotiations are not stored and must be restarted after switchover. For more information about GRES, see the [Junos OS High Availability User Guide](#).

You enable service packages per PIC, not per port. For example, if you configure the Layer 2 service package, the entire PIC uses the configured package. To enable a service package, include the service-

package statement at the [edit chassis fpc *slot-number* pic *pic-number* adaptive-services] hierarchy level, and specify layer-2 or layer-3:

```
[edit chassis fpc slot-number pic pic-number adaptive-services]
  service-package (layer-2 | layer-3);
```

To determine which package an AS PIC supports, issue the show chassis hardware command: if the PIC supports the Layer 2 package, it is listed as Link Services II, and if it supports the Layer 3 package, it is listed as Adaptive Services II. To determine which package a Multiservices PIC supports, issue the show chassis pic fpc-slot *slot-number* pic-slot *slot-number* command. The Package field displays the value Layer-2 or Layer-3.



**NOTE:** The ASM has a default option (layer-2-3) that combines the features available in the Layer 2 and Layer 3 service packages.

After you commit a change in the service package, the PIC is taken offline and then brought back online immediately. You do not need to manually take the PIC offline and online.



**NOTE:** Changing the service package causes all state information associated with the previous service package to be lost. You should change the service package only when there is no active traffic going to the PIC.

The services supported in each package differ by PIC and platform type. [Table 2 on page 14](#) lists the services supported within each service package for each PIC and platform.

On the AS and Multiservices PICs, link services support includes Junos OS CoS components, LFI (FRF.12), MLFR end-to-end (FRF.15), MLFR UNI NNI (FRF.16), MLPPP (RFC 1990), and multiclass MLPPP. For more information, see ["Layer 2 Service Package Capabilities and Interfaces" on page 17](#) and ["Layer 2 Service Package Capabilities and Interfaces"](#).



**NOTE:** The AS PIC II for Layer 2 Service is dedicated to supporting the Layer 2 service package only.

**Table 2: AS and Multiservices PIC Services by Service Package, PIC, and Platform**

Services	ASM	AS/AS2 PICs and Multiservices PICs	AS/AS2 and Multiservices PICs	AS2 and Multiservices PICs	AS2 and Multiservices PICs
<b>Layer 2 Service Package (Only)</b>	<b>M7i</b>	<b>M7i, M10i, and M20</b>	<b>M40e and M120</b>	<b>M320, T320, and T640</b>	<b>TX Matrix</b>
<b>Link Services:</b>					
• Link services	Yes	Yes	Yes	Yes	No
• Multiclass MLPPP	Yes	Yes	Yes	Yes	No
<b>Voice Services:</b>					
• CRTP and LFI	Yes	Yes	Yes	Yes	No
• CRTP and MLPPP	Yes	Yes	Yes	Yes	No
• CRTP over PPP (without MLPPP)	Yes	Yes	Yes	Yes	No
<b>Layer 3 Service Package (Only)</b>	<b>M7i</b>	<b>M7i, M10i, and M20</b>	<b>M40e and M120</b>	<b>M320, T320, and T640</b>	<b>TX Matrix</b>
<b>Security Services:</b>					
• CoS	Yes	Yes	Yes	Yes	No
• Intrusion detection system (IDS)	Yes	Yes	Yes	Yes	No
• IPsec	Yes	Yes	Yes	Yes	No

**Table 2: AS and Multiservices PIC Services by Service Package, PIC, and Platform *(Continued)***

Services	ASM	AS/AS2 PICs and Multiservices PICs	AS/AS2 and Multiservices PICs	AS2 and Multiservices PICs	AS2 and Multiservices PICs
• NAT	Yes	Yes	Yes	Yes	No
• Stateful firewall	Yes	Yes	Yes	Yes	No
<hr/>					
Accounting Services:					
• Active monitoring	Yes	Yes	Yes	Yes	Yes
• Dynamic flow capture (Multiservices 400 PIC only)	No	No	No	Yes	No
• Flow-tap	Yes	Yes	Yes (M40e only)	Yes	No
• Passive monitoring (Multiservices 400 PIC only)	No	Yes	Yes (M40e only)	Yes	No
• Port mirroring	Yes	Yes	Yes	Yes	Yes
<hr/>					
LNS Services:					
• L2TP LNS	Yes	Yes (M7i and M10i only)	Yes (M120 only)	No	No
<hr/>					
Voice Services:					
• BGF	Yes	Yes	Yes	Yes	No
<hr/>					

**Table 2: AS and Multiservices PIC Services by Service Package, PIC, and Platform (Continued)**

Services	ASM	AS/AS2 PICs and Multiservices PICs	AS/AS2 and Multiservices PICs	AS2 and Multiservices PICs	AS2 and Multiservices PICs
<b>Layer 2 and Layer 3 Service Package (Common Features)</b>	<b>M7i</b>	<b>M7i, M10i, and M20</b>	<b>M40e and M120</b>	<b>M320, T320, and T640</b>	<b>TX Matrix</b>
<hr/>					
RPM Services:					
<ul style="list-style-type: none"> <li>• RPM probe timestamping</li> </ul>					
<ul style="list-style-type: none"> <li>• RPM probe timestamping</li> </ul>					
<hr/>					
Tunnel Services:					
<ul style="list-style-type: none"> <li>• GRE (<i>gr-fpc/pic/port</i>)</li> </ul>					
<ul style="list-style-type: none"> <li>• GRE fragmentation (clear-dont-fragment-bit)</li> </ul>					
<ul style="list-style-type: none"> <li>• GRE key</li> </ul>					
<ul style="list-style-type: none"> <li>• IP-IP tunnels (<i>ip-fpc/pic/port</i>)</li> </ul>					
<ul style="list-style-type: none"> <li>• Logical tunnels (<i>lt-fpc/pic/port</i>)</li> </ul>					
<ul style="list-style-type: none"> <li>• Multicast tunnels (<i>mt-fpc/pic/port</i>)</li> </ul>					
<ul style="list-style-type: none"> <li>• PIM de-encapsulation (<i>pd-fpc/pic/port</i>)</li> </ul>					
<ul style="list-style-type: none"> <li>• PIM encapsulation (<i>pe-fpc/pic/port</i>)</li> </ul>					

**Table 2: AS and Multiservices PIC Services by Service Package, PIC, and Platform (Continued)**

Services	ASM	AS/AS2 PICs and Multiservi- ces PICs	AS/AS2 and Multiservice s PICs	AS2 and Multiservi- ces PICs	AS2 and Multiservice s PICs
• Virtual tunnels (vt- <i>fpc/pic/port</i> )	Yes	Yes	Yes	Yes	Yes

## Layer 2 Service Package Capabilities and Interfaces

When you enable the Layer 2 service package, you can configure link services. On the AS and Multiservices PICs and the ASM, link services include support for the following:

- Junos CoS components—*Layer 2 Service Package Capabilities and Interfaces* describes how the Junos CoS components work on link services IQ (lsq) interfaces. For detailed information about Junos CoS components, see the [Junos OS Class of Service User Guide for Routing Devices](#).
- LFI on Frame Relay links using FRF.12 end-to-end fragmentation—The standard for FRF.12 is defined in the specification [FRF.12, Frame Relay Fragmentation Implementation Agreement](#).
- LFI on MLPPP links.
- MLFR UNI NNI (FRF.16)—The standard for FRF.16 is defined in the specification [FRF.16.1, Multilink Frame Relay UNI/NNI Implementation Agreement](#).
- MLPPP (RFC 1990)
- MLFR end-to-end (FRF.15)

For the LSQ interface on the AS and Multiservices PICs, the configuration syntax is almost the same as for Multilink and Link Services PICs. The primary difference is the use of the interface-type descriptor lsq instead of ml or ls. When you enable the Layer 2 service package, the following interfaces are automatically created:

```
gr-fpc/pic/port
ip-fpc/pic/port
lsq-fpc/pic/port
lsq-fpc/pic/port:0
...
lsq-fpc/pic/port:N
mt-fpc/pic/port
```

```
pd-fpc/pic/port
pe-fpc/pic/port
sp-fpc/pic/port
vt-fpc/pic/port
```

Interface types gr, ip, mt, pd, pe, and vt are standard tunnel interfaces that are available on the AS and Multiservices PICs whether you enable the Layer 2 or the Layer 3 service package. These tunnel interfaces function the same way for both service packages, except that the Layer 2 service package does not support some tunnel functions, as shown in [Table 2 on page 14](#).

Interface type lsq-fpc/pic/port is the physical link services IQ (lsq) interface. Interface types lsq-fpc/pic/port:0 through lsq-fpc/pic/port:N represent FRF.16 bundles. These interface types are created when you include the mlfr-uni-nni-bundles statement at the [edit chassis fpc slot-number pic pic-number] option. For more information, see *Layer 2 Service Package Capabilities and Interfaces* and [Link and Multilink Services Interfaces User Guide for Routing Devices](#).



**NOTE:** Interface type sp is created because it is needed by the Junos OS. For the Layer 2 service package, the sp interface is not configurable, but you should not disable it.

## SEE ALSO

[Adaptive Services and Multiservices Interfaces Overview](#)

[Packet Flow Through the Adaptive Services or Multiservices PIC](#)

## Services Configuration Procedure

You follow these general steps to configure services:

1. Define application objects by configuring statements at the [edit applications] hierarchy level.
2. Define service rules by configuring statements at the [edit services (ids | ipsec-vpn | nat | stateful-firewall) rule] hierarchy level.
3. Group the service rules by configuring the rule-set statement at the [edit services (ids | ipsec-vpn | nat | stateful-firewall)] hierarchy level.
4. Group service rule sets under a service-set definition by configuring the service-set statement at the [edit services] hierarchy level.
5. Apply the service set on an interface by including the service-set statement at the [edit interfaces interface-name unit logical-unit-number family inet service (input | output)] hierarchy level. Alternatively,

you can configure logical interfaces as a next-hop destination by including the `next-hop-service` statement at the [edit services service-set *service-set-name*] hierarchy level.



**NOTE:** You can configure IDS, NAT, and stateful firewall service rules within the same service set. You must configure IPsec services in a separate service set, although you can apply both service sets to the same PIC.

## Example: Service Interfaces Configuration

The following configuration includes all the items necessary to configure services on an interface:

```
[edit]
interfaces {
    fe-0/1/0 {
        unit 0 {
            family inet {
                service {
                    input {
                        service-set Firewall-Set;
                    }
                    output {
                        service-set Firewall-Set;
                    }
                }
                address 10.1.3.2/24;
            }
        }
    }
    fe-0/1/1 {
        unit 0 {
            family inet {
                filter {
                    input Sample;
                }
                address 172.16.1.2/24;
            }
        }
    }
    sp-1/0/0 {
```

```
unit 0 {
    family inet {
        address 172.16.1.3/24 {
        }
    }
}

forwarding-options {
    sampling {
        input {
            family inet {
                rate 1;
            }
        }
        output {
            cflowd 10.1.3.1 {
                port 2055;
                version 5;
            }
            flow-inactive-timeout 15;
            flow-active-timeout 60;
            interface sp-1/0/0 {
                engine-id 1;
                engine-type 136;
                source-address 10.1.3.2;
            }
        }
    }
}

firewall {
    filter Sample {
        term Sample {
            then {
                count Sample;
                sample;
                accept;
            }
        }
    }
}

services {
    stateful-firewall {
```

```
rule Rule1 {
    match-direction input;
    term 1 {
        from {
            application-sets Applications;
        }
        then {
            accept;
        }
    }
    term accept {
        then {
            accept;
        }
    }
}
rule Rule2 {
    match-direction output;
    term Local {
        from {
            source-address {
                10.1.3.2/32;
            }
        }
        then {
            accept;
        }
    }
}
ids {
    rule Attacks {
        match-direction output;
        term Match {
            from {
                application-sets Applications;
            }
            then {
                logging {
                    syslog;
                }
            }
        }
    }
}
```

```
        }
    }
nat {
    pool public {
        address-range low 172.16.2.1 high 172.16.2.32;
        port automatic;
    }
    rule Private-Public {
        match-direction input;
        term Translate {
            then {
                translated {
                    source-pool public;
                    translation-type source napt-44;
                }
            }
        }
    }
}
service-set Firewall-Set {
    stateful-firewall-rules Rule1;
    stateful-firewall-rules Rule2;
    nat-rules Private-Public;
    ids-rules Attacks;
    interface-service {
        service-interface sp-1/0/0;
    }
}
}
applications {
    application ICMP {
        application-protocol icmp;
    }
    application FTP {
        application-protocol ftp;
        destination-port ftp;
    }
    application-set Applications {
        application ICMP;
        application FTP;
    }
}
```

## Configuring Default Timeout Settings for Services Interfaces

You can specify global default settings for certain timers that apply for the entire interface. There are three statements of this type:

- `inactivity-timeout`—Sets the inactivity timeout period for established flows, after which they are no longer valid.
- `open-timeout`—Sets the timeout period for Transmission Control Protocol (TCP) session establishment, for use with SYN-cookie defenses against network intrusion.
- `close-timeout`—Sets the timeout period for Transmission Control Protocol (TCP) session tear-down.

To configure a setting for the inactivity timeout period, include the `inactivity-timeout` statement at the `[edit interfaces interface-name services-options]` hierarchy level:

```
[edit interfaces interface-name services-options]
inactivity-timeout seconds;
```

The default value is 30 seconds. The range of possible values is from 4 through 86,400 seconds. Any value you configure in the application protocol definition overrides the value specified here; for more information, see *Configuring Application Properties*.

To configure a setting for the TCP session establishment timeout period, include the `open-timeout` statement at the `[edit interfaces interface-name services-options]` hierarchy level:

```
[edit interfaces interface-name services-options]
open-timeout seconds;
```

The default value is 5 seconds. The range of possible values is from 4 through 224 seconds. Any value you configure in the intrusion detection service (IDS) definition overrides the value specified here; for more information, see *Configuring IDS Rules on an MS-DPC*.

To configure a setting for the TCP session teardown timeout period, include the `close-timeout` statement at the `[edit interfaces interface-name services-options]` hierarchy level:

```
[edit interfaces interface-name services-options]
close-timeout seconds;
```

The default value is 1 second. The range of possible values is from 2 through 300 seconds.

Use of Keep-Alive Messages for Greater Control of TCP Inactivity Timeouts

Keep-alive messages are generated automatically to prevent TCP inactivity timeouts. The default number of keep-alive messages is 4. However, you can configure the number of keep-alive messages by entering the `tcp-tickles` statement at the `[edit interfaces interface-name service-options]` hierarchy level.

When timeout is generated for a bidirectional TCP flow, keep-alive packets are sent to reset the timer. If number of consecutive keep-alive packets sent in a flow reaches the default or configured limit, the conversation is deleted. There are several possible scenarios, depending on the setting of the `inactivity-timer` and the default or configured maximum number of keep-alive messages.

- If the configured value of keep-alive messages is zero and `inactivity-timeout` is NOT configured (in which case the default timeout value of 30 is used), no keep-alive packets are sent. The conversation is deleted when any flow in the conversation is idle for more than 30 seconds.
- If the configured value of keep-alive messages is zero and the `inactivity-timeout` is configured, no keep-alive packets are sent, and the conversation is deleted when any flow in the conversation is idle for more than the configured timeout value.
- If the default or configured maximum number of keep-alive messages is some positive integer, and any of the flows in a conversation is idle for more than the default or configured value for `inactivity-timeout` keep-alive packets are sent. If hosts do not respond to the configured number of consecutive keep-alive packets, the conversation is deleted. The interval between keep-alive packets will be 1 second. However, if the host sends back an ACK packet, the corresponding flow becomes active, and keep-alive packets are not sent until the flow becomes idle again.

## SEE ALSO

[Configuring the Address and Domain for Services Interfaces](#)

[Applying Filters and Services to Interfaces](#)

[Examples: Configuring Services Interfaces](#)

## Configuring System Logging for Services Interfaces

You specify properties that control how system log messages are generated for the interface as a whole. If you configure different values for the same properties at the `[edit services service-set service-set-name]` hierarchy level, the service-set values override the values configured for the interface. For more information on configuring service-set properties, see *Configuring System Logging for Service Sets*.



**NOTE:** Starting with Junos OS Release 14.2R5, 15.1R3, and 16.1R1, for multiservices (ms-) interfaces, you cannot configure system logging for PCP and ALGs by including the

pcp-logs and alg-logs statements at the [edit services service-set service-set-name syslog host *hostname* class] hierarchy level. An error message is displayed if you attempt to commit a configuration that contains the pcp-logs and alg-logs options to define system logging for PCP and ALGs for ms- interfaces.

To configure interface-wide default system logging values, include the syslog statement at the [edit interfaces *interface-name* services-options] hierarchy level:

```
[edit interfaces interface-name services-options]
syslog {
    host hostname {
        services severity-level;
        facility-override facility-name;
        log-prefix prefix-value;
        port port-number;
    }
}
```

Configure the host statement with a hostname or an IP address that specifies the system log target server. The hostname local directs system log messages to the Routing Engine. For external system log servers, the hostname must be reachable from the same routing instance to which the initial data packet (that triggered session establishment) is delivered. You can specify only one system logging hostname.

Starting with Junos OS release 17.4R1, you can configure up to a maximum of four system log servers (combination of local system log hosts and remote system log collectors) for each service set for ms interface under [edit interfaces *interface-name* services-options] hierarchy.

[Table 3 on page 25](#) lists the severity levels that you can specify in configuration statements at the [edit interfaces *interface-name* services-options syslog host *hostname*] hierarchy level. The levels from emergency through info are in order from highest severity (greatest effect on functioning) to lowest.

**Table 3: System Log Message Severity Levels**

Severity Level	Description
any	Includes all severity levels
emergency	System panic or other condition that causes the router to stop functioning

**Table 3: System Log Message Severity Levels (Continued)**

Severity Level	Description
alert	Conditions that require immediate correction, such as a corrupted system database
critical	Critical conditions, such as hard drive errors
error	Error conditions that generally have less serious consequences than errors in the emergency, alert, and critical levels
warning	Conditions that warrant monitoring
notice	Conditions that are not errors but might warrant special handling
info	Events or nonerror conditions of interest

We recommend setting the system logging severity level to `error` during normal operation. To monitor PIC resource usage, set the level to `warning`. To gather information about an intrusion attack when an intrusion detection system error is detected, set the level to `notice` for a specific interface. To debug a configuration or log Network Address Translation (NAT) functionality, set the level to `info`.

For more information about system log messages, see the [System Log Explorer](#).

To use one particular facility code for all logging to the specified system log host, include the facility-override statement at the `[edit interfaces interface-name services-options syslog host hostname]` hierarchy level:

```
[edit interfaces interface-name services-options]
facility-override facility-name;
```

The supported facilities include `authorization`, `daemon`, `ftp`, `kernel`, `user`, and `local0` through `local7`.

To specify a text prefix for all logging to this system log host, include the `log-prefix` statement at the `[edit interfaces interface-name services-options syslog host hostname]` hierarchy level:

```
[edit interfaces interface-name services-options]
log-prefix prefix-value;
```

## SEE ALSO

[Services PICs-Overview | 2](#)

*Configuring the Address and Domain for Services Interfaces*

*Applying Filters and Services to Interfaces*

*Examples: Configuring Services Interfaces*

## Configuring the TLS Syslog Protocol on MS-MPC and MS-MIC

### IN THIS SECTION

- [Transport Layer Security \(TLS\) Overview | 27](#)
- [TLS Transport Protocol for Syslog Messages Configuration Overview | 29](#)
- [Configuring TCP/TLS for Syslog Messages | 31](#)

## Transport Layer Security (TLS) Overview

### IN THIS SECTION

- [Benefits of TLS | 28](#)
- [Three Essential Services of TLS | 28](#)
- [TLS Handshake | 28](#)
- [Encrypting Syslog Traffic with TLS | 29](#)
- [TLS Versions | 29](#)

Starting with Junos OS Release 19.1R1, you can configure Transport Layer Security (TLS) for syslog messages generated by the services that run on the MS-MPC or MS-MIC service cards in an MX router. The services may be one of the following:

- Junos Address Aware (formerly referred to as NAT feaures)
- Junos VPN Site Secure (formerly referred to as IPsec features)

- Junos Network Secure (formerly referred to as Stateful Firewall features)

Transport Layer Security (TLS) is an application-level protocol that provides encryption technology for the Internet. TLS relies on certificates and private-public key exchange pairs for this level of security. It is the most widely used security protocol for the applications that require data to be securely exchanged over a network, such as file transfers, VPN connections, instant messaging, and voice over IP (VoIP).

TLS protocol is used for certificate exchange, mutual authentication, and negotiating ciphers to secure the stream from potential tampering and eavesdropping. TLS is sometimes called as Secure Sockets Layer (SSL). TLS and SSL are not interoperable, though TLS currently provides some backward compatibility.

### **Benefits of TLS**

TLS ensures the secure transmission of data between a client and a server through a combination of privacy, authentication, confidentiality, and data integrity.

### **Three Essential Services of TLS**

The TLS protocol is designed to provide three essential services to the applications running above it: encryption, authentication, and data integrity.

- **Encryption**—In order to establish a cryptographically secure data channel, the server and the client must agree on which cipher suites are used and the keys used to encrypt the data. The TLS protocol specifies a well-defined handshake sequence to perform this exchange. TLS uses public key cryptography, which allows the client and server to negotiate a shared secret key without having to establish any prior knowledge of each other, and to do so over an unencrypted channel.
- **Authentication**—As part of the TLS handshake, the protocol allows both server and the client to authenticate their identity. Implicit trust between the client and the server (because the client accepts the certificate generated by the server) is an important aspect of TLS. It is extremely important that server authentication is not compromised; however, in reality, self-signed certificates and certificates with anomalies are in abundance. Anomalies can include expired certificates, instances of common name not matching a domain name, and so forth.
- **Integrity**—With encryption and authentication in place, the TLS protocol does message framing mechanism and signs each message with a Message Authentication Code (MAC). The MAC algorithm does the effective checksum, and the keys are negotiated between the client and the server.

### **TLS Handshake**

Each TLS session begins with a handshake during which the client and server agree on the specific security key and the encryption algorithms to use for that session. At this time, the client also

authenticates the server. Optionally, the server can authenticate the client. Once the handshake is complete, transfer of encrypted data can begin.

### Encrypting Syslog Traffic with TLS

TLS protocol ensures the syslog messages are securely sent and received over the network. TLS uses certificates to authenticate and encrypt the communication. The client authenticates the server by requesting its certificate and public key. Optionally, the server can also request a certificate from the client, thus mutual authentication is also possible.

A certificate on the server that identifies the server and the certificate of certificate authority (CA) issued by the server must be available with the client for TLS to encrypt syslog traffic.

For mutual authentication of client and the server, a certificate with the client that identifies the client and the certificate of CA issued by client must be available on the server. Mutual authentication ensures that the syslog server accepts log messages only from authorized clients.

TLS is used as a secure transport to counter all the primary threats to syslog listed below:

- Confidentiality to counter disclosure of the message contents.
- Integrity-checking to counter modifications to a message on a hop-by-hop basis.
- Server or mutual authentication to counter masquerade.

### TLS Versions

Following are the versions of TLS:

- TLS version 1.0—Provides secure communication over networks by providing privacy and data integrity between communicating applications
- TLS version 1.1—This enhanced version of TLS provides protection against cipher-block chaining (CBC) attacks.
- TLS version 1.2 — This enhanced version of TLS provides improved flexibility for negotiation of cryptographic algorithms.

### TLS Transport Protocol for Syslog Messages Configuration Overview

Starting with Junos OS Release 19.1R1, you can configure an MX series router to use Transport Layer Security (TLS) for syslog messages generated by services that run on the MS-MPC or MS-MIC service cards in an MX series router.

The following services packages are preinstalled and preconfigured on MS-MICs and MS-MPCs:

- Junos Traffic Vision (formerly referred to as Jflow)

- Junos Address Aware (formerly referred to as NAT features)
- Junos VPN Site Secure (formerly referred to as IPsec features)
- Junos Network Secure (formerly referred to as the Stateful Firewall feature)
- Junos Services Crypto Base PIC Package
- Junos Services Application Level Gateways

You can configure a maximum of four syslog servers for each set of services and send encrypted data to the servers.

Syslog messages are sent over a dedicated connection created for a given set of unique configuration parameters:

- Source IP address
- Destination IP address (TCP/TLS server)
- Port
- SSL profile name (For TLS connection)



**NOTE:** If the ssl-profile is not configured under the tcp-log hierarchy, then it is a non-TLS TCP transport.



**NOTE:** If there are multiple service sets that have the TCP/TLS logging configuration with the same parameters as mentioned above, the logs generated from the sessions from all those service sets share the same connection.

This feature supports both IPv4 and IPv6.



**NOTE:** The configured TCP/TLS connection remains up until the configuration is present even if there are no logging events.

TCP/TLS syslog configuration support is provided for secure and reliable logging only on the data plane.

For Aggregated Multi Service (AMS) with multiple active members, each member creates a separate TCP/TLS connection and syslogs generated by each member PIC are sent via their unique connections.

## Configuring TCP/TLS for Syslog Messages

You can use the TCP/TLS transport protocols to send syslog messages in a reliable and secure manner to external syslog servers.

To configure the TCP/TLS protocols for syslog messages:

1. Configure the SSL initiation profile.



**NOTE:** Configuration of SSL initiation profile is optional if you are not using the TLS/TCP option for syslog messages.

```
[edit services]
user@router# set ssl initiation profile ssl-init-profile protocol-version all;
user@router# set ssl initiation profile ssl-init-profile preferred-ciphers strong;
```

**protocol-version**—Default is set to *all*. When set to *all*, SSL version 3 and TLS version 1 is handled. Default is recommended.

**preferred-ciphers**—*strong*—ciphers with key strength  $\geq$  168-bits. Use of strong ciphers is recommended.

See *initiation (Services)* for configuring all the parameters of the initiation statement.

2. Configure the TCP log parameters.

```
[edit services service-set]
user@router# set ss1 syslog host server -ip tcp-log source-address ip-address
```

**source-address**—Source address for tcp logging.

3. Configure SSL profile for TCP logging.

```
[edit services service-set]
user@router# set ss1 syslog host server -ip tcp-log ssl-profile ssl-profile-name
```

**ssl-profile**—SSL profile name for tcp logging

See *profile (SSL Initiation)* for configuring all the options for ssl-profile.

4. [Optional] Configure routing instance name for tcp logging.

```
[edit services service-set]
user@router# set ss1 syslog host server -ip tcp-log vrf-name vrf-name
```

*vrf-name*—Routing instance name for tcp logging.

5. Commit the configuration.

```
user@router# commit
```

After the commit, the configuration creates a new TCP connection with TLS connection if the SSL profile is configured.

6. Verify the configuration by using the `show services tcp-log connections` command:

```
user@router>show services tcp-log connections
```

```
Interface: ms-2/0/0
Session Id: 1744830467 State: Established
  10.1.1.1 -> 10.40.0.2 : 10214
```

TCP/TLS syslog connection is established with MS-MPC's services L4 data sessions infrastructure and the session's status can be tracked with following command:

```
user@router>show services sessions tcp-log
```

```
ms-2/0/0
Service Set: System, Session: 1744830467, ALG: none, Flags: 0x20000000, IP Action: no,
Offload: no, Asymmetric: no
TCP          10.1.1.1:5229  ->      10.40.0.2:10214  Forward  0
TCP          10.40.0.2:10214 ->      10.1.1.1:5229  Forward  I 15401
```



**NOTE:** The session-id in both the commands should match as highlighted in **bold** above.

### Change History Table

Feature support is determined by the platform and release you are using. Use [Feature Explorer](#) to determine if a feature is supported on your platform.

Release	Description
14.2R5	Starting with Junos OS Release 14.2R5, 15.1R3, and 16.1R1, for multiservices (ms-) interfaces, you cannot configure system logging for PCP and ALGs by including the pcp-logs and alg-logs statements at the [edit services service-set service-set-name syslog host hostname class] hierarchy level.

# 3

CHAPTER

## Configuration Statements and Operational Commands

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### IN THIS CHAPTER

- [Junos CLI Reference Overview | 35](#)

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# Junos CLI Reference Overview

We've consolidated all Junos CLI commands and configuration statements in one place. Read this guide to learn about the syntax and options that make up the statements and commands. Also understand the contexts in which you'll use these CLI elements in your network configurations and operations.

- [Junos CLI Reference](#)

Click the links to access Junos OS and Junos OS Evolved configuration statement and command summary topics.

- [Configuration Statements](#)
- [Operational Commands](#)