

Configuring Aggregated SONET/SDH Interfaces

The JUNOS software enables link aggregation of SONET/SDH interfaces; this is similar to Ethernet link aggregation, but is not defined in a public standard. The JUNOS software balances traffic across the member links within an aggregated SONET/SDH bundle based on the Layer 3 information carried in the packet. This implementation uses the same load balancing algorithm used for per-packet load balancing. For information about per-packet load balancing, see the *JUNOS Routing Protocols Configuration Guide*.

You configure an aggregated SONET/SDH virtual link by specifying the link number as a physical device and then associating a set of physical interfaces that have the same speed. Channelized OC IQ and IQE PICs do not support SONET aggregation.

By default, no aggregated SONET/SDH interfaces are created. You must define the number of aggregated SONET/SDH interfaces by including the **device-count** statement at the `[edit chassis aggregated-devices sonet]` hierarchy level:

```
[edit chassis aggregated-devices sonet]
device-count number;
```

The maximum number of aggregated interfaces is 16. The aggregated SONET/SDH interfaces are numbered from **as0** through **as15**. For more information, see the *JUNOS Services Interfaces Configuration Guide*.



NOTE: SONET/SDH aggregation is proprietary to the JUNOS software and might not work with other software.

To configure aggregated SONET/SDH interfaces, assign a number for the aggregated SONET/SDH interface **asx** at the `[edit interfaces]` hierarchy level:

```
[edit interfaces]
asx {
  ...
}
```

The following example shows an aggregated SONET/SDH configuration:

```
[edit interfaces]
as0 {
  aggregated-sonet-options {
    minimum-links 1;
    [Unresolved xref] oc3;
  }
  unit 0 {
    family inet {
      address 10.2.11.1/32 {
        destination 10.2.11.3;
      }
    }
  }
}
```

```
}
```

You also need to specify the constituent physical interfaces by including the **aggregate** statement at the `[edit interfaces interface-name sonet-options]` hierarchy level; for more information, see “Configuring SONET/SDH Link Aggregation” on page 2. You can optionally specify other physical properties that apply specifically to the aggregated SONET/SDH interfaces; for details, see Configuring SONET/SDH Physical Interface Properties. For a sample configuration, see “Example: Configuring Aggregated SONET/SDH Interfaces” on page 5.

To remove the configuration statements related to **asx** and set the aggregated SONET/SDH interface to down state, delete the interface from the configuration:

```
[edit]
user@host# delete interfaces asx
```

However, the aggregated SONET/SDH interface is not deleted until you delete the chassis **aggregated-devices sonet device-count** configuration statement.

You can configure the following aggregated SONET/SDH properties:

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Configuring SONET/SDH Link Aggregation

On SONET/SDH interfaces, you can associate a physical interface with an aggregated SONET/SDH interface. To associate the interface with an aggregated SONET/SDH link, include the **aggregate** statement at the `[edit interfaces interface-name sonet-options]` hierarchy level:

```
[edit interfaces interface-name sonet-options]
[Unresolved xref] asx;
```

x is the interface instance number and can be from 0 through 15, for a total of 16 aggregated interfaces. You should not mix SONET and SDH mode on the same aggregated interface. You must also include a statement configuring **asx** at the `[edit interfaces]` hierarchy level. For a sample configuration, see “Example: Configuring Aggregated SONET/SDH Interfaces” on page 5.

Configuring Aggregated SONET/SDH Link Speed

On aggregated SONET/SDH interfaces, you can set the required link speed for all interfaces included in the bundle, or specify that the bundle contains interfaces with mixed interface speeds.



NOTE: For nonconcatenated interfaces on aggregated SONET/SDH interfaces, you can configure the link speed of the aggregate to match the speed of the nonconcatenated interface. For example, an OC12 PIC can have nonconcatenated interfaces with a link speed of OC3.

To set the required link speed or specify mixed interface speeds, include the `link-speed` statement at the `[edit interfaces interface-name aggregated-sonet-options]` hierarchy level:

```
[edit interfaces interface-name aggregated-sonet-options]  
[Unresolved xref] (speed | mixed);
```

The link speed can be one of the following values:

- `oc3`—Links are OC3c or STM1c.
- `oc12`—Links are OC12c or STM4c.
- `oc48`—Links are OC48c or STM16c.
- `oc192`—Links are OC192c or STM64c.
- `oc768`—Links are OC768c or STM256c.

Configuring Aggregated SONET/SDH Minimum Links

On aggregated SONET/SDH interfaces, you can configure the minimum number of links that must be up for the bundle as a whole to be labeled `up`. By default, only one link must be up for the bundle to be labeled `up`.

To configure the minimum number of links, include the `minimum-links` statement at the `[edit interfaces interface-name aggregated-sonet-options]` hierarchy level:

```
[edit interfaces interface-name aggregated-sonet-options]  
minimum-links number;
```

On a T-series, TX matrix routing platform with SONET interfaces, the valid range for `minimum-links number` is from 1 through 16. When the maximum value (16) is specified, all configured links of a bundle must be up for the bundle to be labeled `up`.

On all other router platforms, the range of valid values for `minimum-links number` is 1 through 8 and the maximum number of links supported in an aggregate is eight. When the maximum value (8) is specified, all configured links of a bundle must be up for the bundle to be labeled `up`.

Configuring Filters or Sampling on Aggregated SONET/SDH Links

To set up firewall filters or sampling on aggregated SONET/SDH interfaces, you must configure the `asx` interface with these properties. The filters function in the same manner as on other interfaces.

To configure a filter, include the **filter** statement:

```
filter {  
    input input-filter-name;  
    output output-filter-name;  
}
```

You can include this statement at the following hierarchy levels:

- [edit interfaces as x unit *logical-unit-number*]
- [edit logical-systems *logical-system-name* interfaces asx unit *logical-unit-number*]

You must also configure separate statements that define the properties of the filter. For more information, see the *JUNOS Policy Framework Configuration Guide* and “Examples: Configuring Filters or Sampling on Aggregated SONET/SDH Links” on page 4.

Examples: Configuring Filters or Sampling on Aggregated SONET/SDH Links

Configure filtering on aggregated SONET/SDH interfaces:

```
[edit interfaces]  
asx {  
    unit 0 {  
        family inet {  
            address 10.2.11.1/32 {  
                destination 10.2.11.3;  
            }  
            filter {  
                input input-filter-name;  
                output output-filter-name;  
            }  
        }  
    }  
}
```

Defining the Filter

```
[edit firewall]  
filter input-filter-name {  
    term match-any-input {  
        then {  
            accept;  
        }  
    }  
}  
filter output-filter-name {  
    term match-any-output {  
        then {  
            accept;  
        }  
    }  
}
```

**Configuring Sampling on
an Aggregated
SONET/SDH Interface**

```
[edit interfaces]
asx {
  unit 0 {
    family inet {
      address 10.2.11.1/32 {
        destination 10.2.11.3;
      }
      filter {
        input input-sampler-name;
      }
    }
  }
}
```

**Defining the Sampling
Filter and the
Forwarding Action**

```
[edit firewall]
filter input-sampler-name {
  term match-any-input {
    then {
      sample;
      accept;
    }
  }
}
[edit forwarding-options]
sampling {
  input {
    family inet {
      rate 10000;
      run-length 1;
    }
  }
}
```

Example: Configuring Aggregated SONET/SDH Interfaces

The following configuration is sufficient to get an aggregated SONET/SDH interface up and running:

```
[edit interfaces]
as0 {
  aggregated-sonet-options {
    minimum-links 1;
    link-speed oc3;
  }
  unit 0 {
    family inet {
      address 10.2.11.1/32 {
        destination 10.2.11.3;
      }
    }
  }
}
[edit chassis]
aggregated-devices {
```

```
sonet {  
    device-count 15;  
}  
[edit interfaces]  
so-1/3/0 {  
    sonet-options {  
        aggregate as0;  
    }  
}
```