

ALARM Module

IETF 97

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Features

- Alarm list
 - A list of all alarms.
 - Cleared alarms stay in the list until explicitly removed.
 - Optional alarm history (state changes) [YANG feature]
- Operator actions on alarms [YANG feature]
 - Acknowledging and closing alarms
- Alarm inventory
 - A management application can read all alarm types implemented by the system.
- Alarm shelving [YANG feature]
 - Shelving (blocking) alarms according to specific criteria.
- Administrative actions on alarms
 - Purging alarms from the list according to specific criteria.
- X.733 Mapping [Augmenting module]

What is an alarm?

*An alarm signifies an undesirable state in a resource **that requires corrective action**. Not events in general.*

KEY

(resource,	alarm-type,	severity,	clearance-flag)	
GigabitEthernet0/25,	linkAlarm,	Major,	-	→
GigabitEthernet0/25,	linkAlarm,	Major,	Clear	→
GigabitEthernet0/25,	linkAlarm,	Minor,	-	→
GigabitEthernet0/25,	linkAlarm,	Minor,	Clear	→

Alarm **State** on a resource



This module focuses here!

Alarm **Notifications**



X.733 and other alarm modules focus here!

The Alarm List

- Stateful
 - NOT a notification log
- f(resource, alarm-type)
-> current alarm state
- Clearance is separate from severity
- Resource state separate from operator state
 - For example: no manual clear

```
+---ro alarm-list
+---ro number-of-alarms? yang:gauge32
+---ro last-changed? yang:date-and-time
+---ro alarm* [resource alarm-type-id alarm-type-qualifier]
+---ro time-created yang:date-and-time
+---ro resource resource
+---ro alarm-type-id alarm-type-id
+---ro alarm-type-qualifier alarm-type-qualifier
+---ro alt-resource* resource
+---ro related-alarm*
| [resource alarm-type-id alarm-type-qualifier]
| +---ro resource
| | -> /alarms/alarm-list/alarm/resource
| +---ro alarm-type-id leafref
| +---ro alarm-type-qualifier leafref
+---ro impacted-resource* resource
+---ro root-cause-resource* resource
+---ro is-cleared boolean
+---ro last-changed yang:date-and-time
+---ro perceived-severity severity
+---ro alarm-text alarm-text
+---ro status-change* [time] {alarm-history}?
| +---ro time yang:date-and-time
| +---ro perceived-severity severity-with-clear
| +---ro alarm-text alarm-text
+---ro operator-state-change* [time] {operator-actions}?
| +---ro time yang:date-and-time
| +---ro operator string
| +---ro state operator-state
| +---ro text? string
+---x set-operator-state {operator-actions}?
+---w input
+---w state operator-state
+---w text? string
```

Alarm Type

ietf-alarms.yang

```
typedef alarm-type-id {
  type identityref {
    base alarm-identity;
  }
  description
    "Identifies an alarm type. The description of the alarm type
    id MUST indicate if the alarm type is abstract or not. An
    abstract alarm type is used as a base for other alarm type ids
    and will not be used as a value for an alarm or be present in
    the alarm inventory.";
}

typedef alarm-type-qualifier {
  type string;
  description
    "If an alarm type can not be fully specified at design time by
    alarm-type-id, this string qualifier is used in addition to
    fully define a unique alarm type.

    The definition of alarm qualifiers is considered being part
    of the instrumentation and out of scope for this module.
    An empty string is used when this is part of a key.";
}
```

Enterprise module

```
module example-xyz-alarms {
  namespace "urn:example:xyz-alarms";
  prefix xyz-al;

  import ietf-alarms {
    prefix al;
  }

  identity xyz-alarms {
    base al:alarm-identity;
  }

  identity communications-alarm {
    base xyz-alarms;
  }
  identity quality-of-service-alarm {
    base xyz-alarms;
  }
  identity processing-error-alarm {
    base xyz-alarms;
  }
  identity equipment-alarm {
    base xyz-alarms;
  }
  identity environmental-alarm {
    base xyz-alarms;
  }

  // communications alarms
  identity link-alarm {
    base communications-alarm;
  }

  // QoS alarms
  identity high-jitter-alarm {
    base quality-of-service-alarm;
  }
}
```

Alarm Type and Alarm Type Qualifier

- Alarm Type Qualifier
- Only used when alarm types are not known at design time
 - Example:
Digital input with configured detector type
- Industry practice of X.733 “specific problem”

```
// Alternative 1: concrete alarm type identity
import ietf-alarms {
    prefix al;
}
identity environmental-alarm {
    base al:alarm-type;
    description "Abstract alarm type";
}
identity smoke {
    base environmental-alarm;
    description "Concrete alarm type";
}

// Alternative 2: concrete alarm type qualifier
import ietf-alarms {
    prefix al;
}
identity environmental-alarm {
    base al:alarm-type;
    description "Abstract alarm type";
}
identity external-detector {
    base environmental-alarm;
    description
        "Abstract alarm type, a run-time configuration
        procedure sets the type of alarm detected. This will
        be reported in the alarm-qualifier.";
}
}
```

Identifying Resources

- Instance Identifier
- SNMP OID
- String for other naming schemes like DN
- Part of key
- The alarm allows for alternate naming like referring to the interface
SNMP OID

```
typedef resource {  
  type union {  
    type instance-identifier {  
      require-instance false;  
    }  
    type yang:object-identifier;  
    type string;  
  }  
}
```



```
+--ro alarm* [resource alarm-type-id alarm-type-qualifier]  
  +--ro time-created          yang:date-and-time  
  +--ro resource              resource  
  +--ro alarm-type-id        alarm-type-id  
  +--ro alarm-type-qualifier alarm-type-qualifier  
  +--ro alt-resource*        resource
```

Alarm Life-Cycle

- Resource View
 - Severity, Clearance, Text
- Operator View
 - Ack, Close
- Admin View
 - Delete alarms
 - Compress alarm history

```
+---ro alarm* [resource alarm-type-id alarm-type-qualifier]
...
+---ro is-cleared                boolean
+---ro last-changed              yang:date-and-time
+---ro perceived-severity        severity
+---ro alarm-text                alarm-text
+---ro status-change* [time]
  +---ro time                    yang:date-and-time
  +---ro perceived-severity      severity
  +---ro alarm-text              alarm-text
```

```
+---ro alarm* [resource alarm-type-id alarm-type-qualifier]
...
+---ro operator-state-change* [time] {operator-actions}?
| +---ro time                yang:date-and-time
| +---ro operator            string
| +---ro state                operator-state
| +---ro text?               string
+----x set-operator-state {operator-actions}?
  +---w input
  +---w state                operator-state
  +---w text?                string
```


Alarm Inventory

- Possible alarms
- For which resources?
- Can the operator expect an alarm clearance?

```
+--ro alarm-inventory
|   +--ro alarm-type* [alarm-type-id alarm-type-qualifier]
|       +--ro alarm-type-id          alarm-type-id
|       +--ro alarm-type-qualifier   alarm-type-qualifier
|       +--ro resource*              string
|       +--ro has-clear               boolean
|       +--ro description              string
```

Alarm Shelving

```
-rw alarm-shelving {alarm-shelving}?
+--rw shelf* [shelf-name]
  +--rw shelf-name          string
  +--rw resource?          resource
  +--rw alarm-type-id?     alarm-type-id
  +--rw alarm-type-qualifier? alarm-type-qualifier
  +--rw description?       string
```

- “Filtering/Blocking”
- Move the blocked alarms to the shelf

```
-ro shelved-alarms {alarm-shelving}?
+--ro number-of-shelved-alarms? yang:gauge32
+--ro alarm-shelf-last-changed? yang:date-and-time
+--ro shelved-alarm*
  [resource alarm-type-id alarm-type-qualifier]
  +--ro resource          resource
  +--ro alarm-type-id     alarm-type-id
  +--ro alarm-type-qualifier alarm-type-qualifier
  +--ro alt-resource*     resource
  +--ro related-alarm*
  |   [resource alarm-type-id alarm-type-qualifier]
  |   +--ro resource
  |   |   -> /alarms/alarm-list/alarm/resource
  |   +--ro alarm-type-id     leafref
  |   +--ro alarm-type-qualifier leafref
  +--ro impacted-resource*   resource
  +--ro root-cause-resource* resource
  +--ro is-cleared           boolean
  +--ro last-changed        yang:date-and-time
  +--ro perceived-severity  severity
  +--ro alarm-text          alarm-text
  +--ro status-change* [time] {alarm-history}?
  |   +--ro time          yang:date-and-time
  |   +--ro perceived-severity severity-with-clear
  |   +--ro alarm-text    alarm-text
  +--ro operator-state-change* [time] {operator-actions}?
  |   +--ro time          yang:date-and-time
  |   +--ro operator      string
  |   +--ro state         operator-state
  |   +--ro text?         string
```

Notifications

- Alarm state change notification
- Operator state change notification
- Alarm Inventory changed

RPCs/Actions

- Purge
 - Delete alarms based on specific criteria
 - For example: all alarms with:
 - operator state closed
 - clearance flag true
 - Last changed: older than 24h
- Compress
 - Compress the alarm history
- Set operator state for an alarm

X.733 Mapping

- Augments alarm list, alarm inventory and alarm notification with X.733 parameters
- Optional feature to configure the X.733 mapping

```
module: ietf-alarms-x733
augment /al:alarms/al:alarm-inventory/al:alarm-type:
  +--ro event-type?          event-type
  +--ro probable-cause?     uint32
augment /al:alarms/al:control:
  +--rw x733-mapping* [alarm-type-id alarm-type-qualifier-match]
                        {configure-x733-mapping}?
  +--rw alarm-type-id       al:alarm-type-id
  +--rw alarm-type-qualifier-match string
  +--rw event-type?        event-type
  +--rw probable-cause?    uint32
augment /al:alarms/al:alarm-list/al:alarm:
  +--ro event-type?        event-type
  +--ro probable-cause?    uint32
augment /al:alarms/al:shelved-alarms/al:shelved-alarm:
  +--ro event-type?        event-type
  +--ro probable-cause?    uint32
augment /al:alarm-notification:
  +---- event-type?        event-type
  +---- probable-cause?    uint32
```

References

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