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I2NSF Network Security Functions-Facing Interface YANG Data Model
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Abstract

This document defines a YANG data model corresponding to the information model for Network Security Functions (NSF) facing interface in Interface to Network Security Functions (I2NSF). It describes a data model for the features provided by generic security functions. This data model provides generic components whose vendors is well understood, so that the generic component can be used even if it has some vendor specific functions. These generic functions represent a point of interoperability, and can be provided by any product that offers the required Capabilities. Also, if vendors need additional features for its network security function, they can add the features by extending the YANG data model.

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1. Introduction

This document defines a YANG [RFC6020] data model for the configuration of security services with the information model for Network Security Functions (NSF) facing interface in Interface to Network Security Functions (I2NSF). It provides a specific

information model and the corresponding data models for generic network security functions (i.e., network security functions), as defined in [i2nsf-nsf-cap-im]. With these data model, I2NSF controller can control the capabilities of NSFs.

The "Event-Condition-Action" (ECA) policy model is used as the basis for the design of I2NSF Policy Rules.

The "ietf-i2nsf-nsf-facing-interface" YANG module defined in this document provides the following features:

- o configuration of I2NSF security policy rule for generic network security function policy
- o configuration of event caluse for generic network security function policy
- o configuration of condition caluse for generic network security function policy
- o configuration of action caluse for generic network security function policy

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

3. Terminology

This document uses the terminology described in [i2nsf-nsf-cap-im][i2rs-rib-data-model][supa-policy-info-model]. Especially, the following terms are from [supa-policy-info-model]:

- o Data Model: A data model is a representation of concepts of interest to an environment in a form that is dependent on data repository, data definition language, query language, implementation language, and protocol.
- o Information Model: An information model is a representation of concepts of interest to an environment in a form that is independent of data repository, data definition language, query language, implementation language, and protocol.

3.1. Tree Diagrams

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in these diagrams [i2rs-rib-data-model] is as follows:

- o Brackets "[" and "]" enclose list keys.
- o Abbreviations before data node names: "rw" means configuration (read-write) and "ro" state data (read-only).
- o Symbols after data node names: "?" means an optional node and "*" denotes a "list" and "leaf-list".
- o Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- o Ellipsis ("...") stands for contents of subtrees that are not shown.

4. Objectives

4.1. I2NSF Security Policy Rule

This shows a identification of policy for generic network security functions. These objects are defined as policy information and rule information. This includes ECA Policy Rule, Event Clause Objects, Condition Clause Objects, and Action Clause Objects, Resolution Strategy, Default Action.

4.2. Event Caluse

This shows a event caluse for generic network security functions. An Event is any important occurrence in time of a change in the system being managed, and/or in the environment of the system being managed. When used in the context of I2NSF Policy Rules, it is used to determine whether the Condition clause of the I2NSF Policy Rule can be evaluated or not. These objects are defined as user security event, device security event, system security event, and time security event. These objects can be extended according to specific vendor event features.

4.3. Condition Caluse

This shows a condition caluse for generic network security functions. A condition is defined as a set of attributes, features, and/or values that are to be compared with a set of known attributes, features, and/or values in order to determine whether or not the set

of Actions in that (imperative) I2NSF Policy Rule can be executed or not. These objects are defined as user security event, device security event, system security event, and time security event. These objects are defined as packet security condition, packet payload security condition, target security condition, user security condition, context condition, and generic context condition. These objects can be extended according to specific vendor condition features.

4.4. Action Caluse

This shows a action caluse for generic network security functions. An action is used to control and monitor aspects of flow-based NSFs when the event and condition clauses are satisfied. NSFs provide security functions by executing various Actions. These objects are defined as ingress action, egress action, and apply profile action. These objects can be extended according to specific vendor action features.

5. Data Model Structure

This section shows an following mapped features of a data model structure tree of generic network security functions, as defined in the [i2nsf-nsf-cap-im].

- o Consideration of ECA Policy Model by Aggregating the Event, Condition, and Action Clauses Objects.
- o Consideration of Capability Algebra.
- o Consideration of NSFs Capability Categories (i.e., Network Security, Content Security, and Attack Mitigation Capabilities).
- o Definitions for Network Security Event Class, Network Security Condition Class, and Network Security Action Class.

5.1. I2NSF Security Policy Rule

The data model for identification of network security policy has the following structure:

```

module: ietf-i2nsf-nsf-facing-interface
+--rw generic-nsf
|   +--rw i2nsf-security-policy* [policy-name]
|   |   +--rw policy-name          string
|   |   +--rw time-zone
|   |   |   +--rw start-time?      yang:date-and-time
|   |   |   +--rw end-time?       yang:date-and-time
|   |   +--rw eca-policy-rules* [rule-id]
|   |   |   +--rw rule-id          uint8
|   |   |   +--rw rule-description? string
|   |   |   +--rw rule-rev?       uint8
|   |   |   +--rw rule-priority?  uint8
|   |   |   +--rw policy-event-clause-aggr-ptr*      instance-identifier
|   |   |   +--rw policy-condition-clause-aggr-ptr*  instance-identifier
|   |   |   +--rw policy-action-clause-aggr-ptr*     instance-identifier
|   |   +--rw resolution-strategy
|   |   |   +--rw (resolution-strategy-type)?
|   |   |   |   +--:(fmr)
|   |   |   |   |   +--rw first-matching-rule?    boolean
|   |   |   |   +--:(lmr)
|   |   |   |   |   +--rw last-matching-rule?     boolean
|   |   +--rw default-action
|   |   |   +--rw default-action-type?    ingress-action
+--rw event-clause-container
|   ...
+--rw condition-clause-container
|   ...
+--rw action-clause-container
|   ...

```

Figure 1: Data Model Structure for Network Security Policy Identification

5.2. Event Clause

The data model for event rule has the following structure:

```

module: ietf-i2nsf-nsf-facing-interface
+--rw generic-nsf
|   +--rw i2nsf-security-policy* [policy-name]
|   |   ...
|   |   +--rw eca-policy-rules* [rule-id]
|   |   |   ...
|   |   +--rw resolution-strategy
|   |   |   ...
|   |   +--rw default-action
|   |   |   ...
+--rw event-clause-container
|   +--rw event-clause-list* [eca-object-id]
|   |   +--rw entity-class?          identityref
|   |   +--rw eca-object-id          string
|   |   +--rw manual?                string
|   |   +--rw sec-event-content       string
|   |   +--rw sec-event-format        sec-event-format
|   |   +--rw sec-event-type          string
+--rw condition-clause-container
|   ...
+--rw action-clause-container
|   ...

```

Figure 2: Data Model Structure for Event Rule

These objects are defined as user security event, device security event, system security event, and time security event. These objects can be extended according to specific vendor event features. We will add additional event objects for more generic network security functions.

5.3. Condition Clause

The data model for condition rule has the following structure:

```

module: ietf-i2nsf-nsf-facing-interface
+--rw generic-nsf
|   +--rw i2nsf-security-policy* [policy-name]
|   |   ...
|   |   +--rw eca-policy-rules* [rule-id]
|   |   |   ...
|   |   +--rw resolution-strategy
|   |   |   ...
|   |   +--rw default-action
|   |   |   ...
+--rw event-clause-container
|   ...
+--rw condition-clause-container

```

```

+--rw condition-clause-list* [eca-object-id]
  +--rw entity-class?                identityref
  +--rw eca-object-id                string
  +--rw (condition-type)?
    +--:(packet-security-condition)
      +--rw packet-manual?            string
      +--rw packet-security-mac-condition
        +--rw pkt-sec-cond-mac-dest*  yang:phys-address
        +--rw pkt-sec-cond-mac-src*    yang:phys-address
        +--rw pkt-sec-cond-mac-8021q*  string
        +--rw pkt-sec-cond-mac-ether-type* string
        +--rw pkt-sec-cond-mac-tci*    string
      +--rw packet-security-ipv4-condition
        +--rw pkt-sec-cond-ipv4-header-length*  uint8
        +--rw pkt-sec-cond-ipv4-tos*            uint8
        +--rw pkt-sec-cond-ipv4-total-length*    uint16
        +--rw pkt-sec-cond-ipv4-id*             uint8
        +--rw pkt-sec-cond-ipv4-fragment*        uint8
        +--rw pkt-sec-cond-ipv4-fragment-offset* uint16
        +--rw pkt-sec-cond-ipv4-ttl*            uint8
        +--rw pkt-sec-cond-ipv4-protocol*        uint8
        +--rw pkt-sec-cond-ipv4-src*             inet:ipv4-address
        +--rw pkt-sec-cond-ipv4-dest*            inet:ipv4-address
        +--rw pkt-sec-cond-ipv4-ipopts?          string
        +--rw pkt-sec-cond-ipv4-sameip?          boolean
        +--rw pkt-sec-cond-ipv4-geoip*          string
      +--rw packet-security-ipv6-condition
        +--rw pkt-sec-cond-ipv6-dscp*           string
        +--rw pkt-sec-cond-ipv6-ecn*            string
        +--rw pkt-sec-cond-ipv6-traffic-class*   uint8
        +--rw pkt-sec-cond-ipv6-flow-label*      uint32
        +--rw pkt-sec-cond-ipv6-payload-length* uint16
        +--rw pkt-sec-cond-ipv6-next-header*     uint8
        +--rw pkt-sec-cond-ipv6-hop-limit*       uint8
        +--rw pkt-sec-cond-ipv6-src*             inet:ipv6-address
        +--rw pkt-sec-cond-ipv6-dest*            inet:ipv6-address
      +--rw packet-security-tcp-condition
        +--rw pkt-sec-cond-tcp-seq-num*          uint32
        +--rw pkt-sec-cond-tcp-ack-num*          uint32
        +--rw pkt-sec-cond-tcp-window-size*      uint16
        +--rw pkt-sec-cond-tcp-flags*            uint8
      +--rw packet-security-udp-condition
        +--rw pkt-sec-cond-udp-length*           string
      +--rw packet-security-icmp-condition
        +--rw pkt-sec-cond-icmp-type*            uint8
        +--rw pkt-sec-cond-icmp-code*            uint8
        +--rw pkt-sec-cond-icmp-seg-num*         uint32
    +--:(packet-payload-condition)

```

```

|         | +--rw packet-payload-manual?           string
|         | +--rw pkt-payload-content*             string
|         | +---:(target-condition)
|         | | +--rw target-manual?                 string
|         | | +--rw device-sec-context-cond
|         | |   +--rw pc?                          boolean
|         | |   +--rw mobile-phone?                boolean
|         | |   +--rw voip-volte-phone?            boolean
|         | |   +--rw tablet?                      boolean
|         | |   +--rw iot?                         boolean
|         | |   +--rw vehicle?                     boolean
|         | +---:(users-condition)
|         | | +--rw users-manual?                   string
|         | | +--rw user
|         | | | +--rw (user-name)?
|         | | | | +---:(tenant)
|         | | | | | +--rw tenant                  uint8
|         | | | | +---:(vn-id)
|         | | | | | +--rw vn-id                   uint8
|         | | +--rw group
|         | | | +--rw (group-name)?
|         | | | | +---:(tenant)
|         | | | | | +--rw tenant                  uint8
|         | | | | +---:(vn-id)
|         | | | | | +--rw vn-id                   uint8
|         | +---:(context-condition)
|         | | +--rw context-manual?                 string
|         | +---:(gen-context-condition)
|         | | +--rw gen-context-manual?             string
|         | | +--rw geographic-location
|         | |   +--rw src-geographic-location*      uint32
|         | |   +--rw dest-geographic-location*     uint32
|         | +--rw action-clause-container
|         | ...

```

Figure 3: Data Model Structure for Condition Rule

These objects are defined as packet security condition, packet payload security condition, target security condition, user security condition, context condition, and generic context condition. These objects can be extended according to specific vendor condition features. We will add additional condition objects for more generic network security functions.

5.4. Action Clause

The data model for action rule has the following structure:

```

module: ietf-i2nsf-nsf-facing-interface
+--rw generic-nsf
|   +--rw i2nsf-security-policy* [policy-name]
|   |   ...
|   |   +--rw eca-policy-rules* [rule-id]
|   |   |   ...
|   |   +--rw resolution-strategy
|   |   |   ...
|   |   +--rw default-action
|   |   |   ...
+--rw event-clause-container
|   ...
+--rw condition-clause-container
|   ...
+--rw action-clause-container
|   +--rw action-clause-list* [eca-object-id]
|   |   +--rw entity-class? identityref
|   |   +--rw eca-object-id string
|   |   +--rw (action-type)?
|   |   |   +--:(ingress-action)
|   |   |   |   +--rw ingress-manual? string
|   |   |   |   +--rw ingress-action-type? ingress-action
|   |   |   +--:(egress-action)
|   |   |   |   +--rw egress-manual? string
|   |   |   |   +--rw egress-action-type? egress-action
|   |   |   +--:(apply-profile)
|   |   |   |   +--rw profile-manual? string
|   |   |   |   +--rw (apply-profile-action-type)?
|   |   |   |   |   +--:(content-security-control)
|   |   |   |   |   |   +--rw content-security-control-types
|   |   |   |   |   |   |   +--rw antivirus? boolean
|   |   |   |   |   |   |   +--rw ips? boolean
|   |   |   |   |   |   |   +--rw ids? boolean
|   |   |   |   |   |   |   +--rw url-filtering? boolean
|   |   |   |   |   |   |   +--rw data-filtering? boolean
|   |   |   |   |   |   |   +--rw mail-filtering? boolean
|   |   |   |   |   |   |   +--rw file-blocking? boolean
|   |   |   |   |   |   |   +--rw file-isolate? boolean
|   |   |   |   |   |   |   +--rw pkt-capture? boolean
|   |   |   |   |   |   |   +--rw application-control? boolean
|   |   |   |   |   |   |   +--rw voip-volte? boolean
|   |   |   |   |   +--:(attack-mitigation-control)
|   |   |   |   |   |   +--rw (attack-mitigation-control-type)?
|   |   |   |   |   |   |   +--:(ddos-attack)

```

```

|   |--rw ddos-attack-type
|   |   |--rw network-layer-ddos-attack
|   |   |   |--rw network-layer-ddos-attack-type
|   |   |   |   |--rw syn-flood?        boolean
|   |   |   |   |--rw udp-flood?        boolean
|   |   |   |   |--rw icmp-flood?       boolean
|   |   |   |   |--rw ip-frag-flood?    boolean
|   |   |   |   |--rw ipv6-related?    boolean
|   |   |--rw app-layer-ddos-attack
|   |   |   |--rw app-ddos-attack-types
|   |   |   |   |--rw http-flood?       boolean
|   |   |   |   |--rw https-flood?      boolean
|   |   |   |   |--rw dns-flood?        boolean
|   |   |   |   |--rw dns-amp-flood?    boolean
|   |   |   |   |--rw ssl-ddos?         boolean
|--:(single-packet-attack)
|   |--rw single-packet-attack-type
|   |   |--rw scan-and-sniff-attack
|   |   |   |--rw scan-and-sniff-attack-types
|   |   |   |   |--rw ip-sweep?         boolean
|   |   |   |   |--rw port-scanning?    boolean
|   |--rw malformed-packet-attack
|   |   |--rw malformed-packet-attack-types
|   |   |   |--rw ping-of-death?        boolean
|   |   |   |--rw teardrop?             boolean
|   |--rw special-packet-attack
|   |   |--rw special-packet-attack-types
|   |   |   |--rw oversized-icmp?      boolean
|   |   |   |--rw tracert?             boolean

```

Figure 4: Data Model Structure for Action Rule

These objects are defined as ingress action, egress action, and apply profile action. These objects can be extended according to specific vendor action feature. We will add additional action objects for more generic network security functions.

6. YANG Module

6.1. IETF NSF-Facing Interface YANG Data Module

This section introduces a YANG module for the information model of network security functions, as defined in the [i2nsf-nsf-cap-im].

<CODE BEGINS> file "ietf-i2nsf-nsf-facing-interface@2017-10-30.yang"

```

module ietf-i2nsf-nsf-facing-interface {
  yang-version 1.1;

```

```
namespace
  "urn:ietf:params:xml:ns:yang:ietf-i2nsf-nsf-facing-interface";
prefix
  nsf-facing-interface;

import ietf-inet-types{
  prefix inet;
}
import ietf-yang-types{
  prefix yang;
}

organization
  "IETF I2NSF (Interface to Network Security Functions)
  Working Group";

contact
  "WG Web: <http://tools.ietf.org/wg/i2nsf>
  WG List: <mailto:i2nsf@ietf.org>

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  Editor: Susan Hares
  <mailto:shares@ndzh.com>";

description
  "This module defines a YANG data module for network security
  functions.";
revision "2017-10-30"{
  description "The third revision";
  reference
    "draft-ietf-i2nsf-capability-00";
}

typedef sec-event-format {
  type enumeration {
    enum unknown {
      description
```

```
        "If SecEventFormat is unknown";
    }
    enum guid {
        description
            "If SecEventFormat is GUID
             (Generic Unique Identifier)";
    }
    enum uuid {
        description
            "If SecEventFormat is UUID
             (Universal Unique Identifier)";
    }
    enum uri {
        description
            "If SecEventFormat is URI
             (Uniform Resource Identifier)";
    }
    enum fqdn {
        description
            "If SecEventFormat is FQDN
             (Fully Qualified Domain Name)";
    }
    enum fqpn {
        description
            "If SecEventFormat is FQPN
             (Fully Qualified Path Name)";
    }
}
description
    "This is used for SecEventFormat.";
}

typedef ingress-action {
    type enumeration {
        enum pass {
            description
                "If ingress action is pass";
        }
        enum drop {
            description
                "If ingress action is drop";
        }
        enum reject {
            description
                "If ingress action is reject";
        }
        enum alert {
            description
```

```
        "If ingress action is alert";
    }
    enum mirror {
        description
            "If ingress action is mirror";
    }
}
description
    "This is used for ingress action.";
}

typedef egress-action {
    type enumeration {
        enum invoke-signaling {
            description
                "If egress action is invoke signaling";
        }
        enum tunnel-encapsulation {
            description
                "If egress action is tunnel encapsulation";
        }
        enum forwarding {
            description
                "If egress action is forwarding";
        }
        enum redirection {
            description
                "If egress action is redirection";
        }
    }
    description
        "This is used for egress action.";
}

identity ECA-OBJECT-TYPE {
    description "TBD";
}

identity ECA-EVENT-TYPE {
    base ECA-OBJECT-TYPE;
    description "TBD";
}

identity ECA-CONDITION-TYPE {
    base ECA-OBJECT-TYPE;
    description "TBD";
}
```

```
identity ECA-ACTION-TYPE {
  base ECA-OBJECT-TYPE;
  description "TBD";
}

identity EVENT-USER-TYPE {
  base ECA-EVENT-TYPE;
  description "TBD";
}

identity EVENT-DEV-TYPE {
  base ECA-EVENT-TYPE;
  description "TBD";
}

identity EVENT-SYS-TYPE {
  base ECA-EVENT-TYPE;
  description "TBD";
}

identity EVENT-TIME-TYPE {
  base ECA-EVENT-TYPE;
  description "TBD";
}

grouping i2nsf-eca-object-type {
  leaf entity-class {
    type identityref {
      base ECA-OBJECT-TYPE;
    }
    description "TBD";
  }
  leaf eca-object-id {
    type string;
    description "TBD";
  }
  description "TBD";
}

grouping i2nsf-event-type {
  description "TBD";
  leaf manual {
    type string;
    description
      "This is manual for event.
       Vendors can write instructions for event
       that vendor made";
  }
}
```

```
}  
  
leaf sec-event-content {  
    type string;  
    mandatory true;  
    description  
        "This is a mandatory string that contains the content  
        of the SecurityEvent. The format of the content  
        is specified in the SecEventFormat class  
        attribute, and the type of event is defined in the  
        SecEventType class attribute. An example of the  
        SecEventContent attribute is a string hrAdmin,  
        with the SecEventFormat set to 1 (GUID) and the  
        SecEventType attribute set to 5 (new logon).";  
}  
  
leaf sec-event-format {  
    type sec-event-format;  
    mandatory true;  
    description  
        "This is a mandatory uint 8 enumerated integer, which  
        is used to specify the data type of the  
        SecEventContent attribute. The content is  
        specified in the SecEventContent class attribute,  
        and the type of event is defined in the  
        SecEventType class attribute. An example of the  
        SecEventContent attribute is string hrAdmin,  
        with the SecEventFormat attribute set to 1 (GUID)  
        and the SecEventType attribute set to 5  
        (new logon).";  
}  
  
leaf sec-event-type {  
    type string;  
    mandatory true;  
    description  
        "This is a mandatory uint 8 enumerated integer, which  
        is used to specify the type of event that involves  
        this user. The content and format are specified in  
        the SecEventContent and SecEventFormat class  
        attributes, respectively. An example of the  
        SecEventContent attribute is string hrAdmin,  
        with the SecEventFormat attribute set to 1 (GUID)  
        and the SecEventType attribute set to 5  
        (new logon).";  
}  
  
}
```

```
container generic-nsf {
  description
    "Configuration for Generic Network Security Functions.";

  list i2nsf-security-policy {
    key "policy-name";
    description
      "policy is a list
      including a set of security rules according to certain logic,
      i.e., their similarity or mutual relations, etc. The network
      security policy is able to apply over both the unidirectional
      and bidirectional traffic across the NSF.";

    leaf policy-name {
      type string;
      mandatory true;
      description
        "The name of the policy.
        This must be unique.";
    }
    container time-zone {
      description
        "This can be used to apply rules according to time";
      leaf start-time {
        type yang:date-and-time;
        description
          "This is start time for time zone";
      }
      leaf end-time {
        type yang:date-and-time;
        description
          "This is end time for time zone";
      }
    }
  }

  list eca-policy-rules {
    key "rule-id";
    description
      "This is a rule for network security functions.";

    leaf rule-id {
      type uint8;
      mandatory true;
      description
        "The id of the rule.
        This must be unique.";
    }
  }
}
```

```
leaf rule-description {
    type string;
    description
        "This description gives more information about
        rules.";
}

leaf rule-rev {
    type uint8;
    description
        "This shows rule version.";
}

leaf rule-priority {
    type uint8;
    description
        "The priority keyword comes with a mandatory
        numeric value which can range from 1 till 255.";
}

leaf-list policy-event-clause-aggr {
    type instance-identifier;
    must 'derived-from-or-self (/event-clause-container/
    event-clause-list/entity-class, "ECA-EVENT-TYPE")';
    description
        "TBD";
}

leaf-list policy-condition-clause-aggr {
    type instance-identifier;
    must 'derived-from-or-self (/condition-clause-container/
    condition-clause-list/entity-class, "ECA-CONDITION-TYPE")';
    description
        "TBD";
}

leaf-list policy-action-clause-aggr {
    type instance-identifier;
    must 'derived-from-or-self (/action-clause-container/
    action-clause-list/entity-class, "ECA-ACTION-TYPE")';
    description
        "TBD";
}

}

container resolution-strategy {
    description
        "The resolution strategies can be used to
        specify how to resolve conflicts that occur between
        the actions of the same or different policy rules that
```

are matched and contained in this particular NSF";

```
choice resolution-strategy-type {
  description
    "Vendors can use YANG data model to configure rules";

  case fmr {
    leaf first-matching-rule {
      type boolean;
      description
        "If the resolution strategy is first matching rule";
    }
  }
  case lmr {
    leaf last-matching-rule {
      type boolean;
      description
        "If the resolution strategy is last matching rule";
    }
  }
}

container default-action {
  description
    "This default action can be used to specify a predefined
    action when no other alternative action was matched
    by the currently executing I2NSF Policy Rule. An analogy
    is the use of a default statement in a C switch statement.";

  leaf default-action-type {
    type ingress-action;
    description
      "Ingress action type: permit, deny, and mirror.";
  }
}

container event-clause-container {
  description "TBD";
  list event-clause-list {
    key eca-object-id;
    uses i2nsf-eca-object-type {
      refine entity-class {
```

```
        default ECA-EVENT-TYPE;
    }
}

description
    " This is abstract. An event is defined as any important
      occurrence in time of a change in the system being
      managed, and/or in the environment of the system being
      managed. When used in the context of policy rules for
      a flow-based NSF, it is used to determine whether the
      Condition clause of the Policy Rule can be evaluated
      or not. Examples of an I2NSF event include time and
      user actions (e.g., logon, logoff, and actions that
      violate any ACL.).";

    uses i2nsf-event-type;
}

container condition-clause-container {
description "TBD";
list condition-clause-list {
    key eca-object-id;
    uses i2nsf-eca-object-type {
        refine entity-class {
            default ECA-CONDITION-TYPE;
        }
    }
}
description
    " This is abstract. A condition is defined as a set
      of attributes, features, and/or values that are to be
      compared with a set of known attributes, features,
      and/or values in order to determine whether or not the
      set of Actions in that (imperative) I2NSF Policy Rule
      can be executed or not. Examples of I2NSF Conditions
      include matching attributes of a packet or flow, and
      comparing the internal state of an NSF to a desired
      state.";

choice condition-type {
    description
        "Vendors can use YANG data model to configure rules
        by concreting this condition type";

    case packet-security-condition {
        leaf packet-manual {
            type string;
            description
                "This is manual for packet condition."
        }
    }
}
```

```
        Vendors can write instructions for packet condition
        that vendor made";
    }

    container packet-security-mac-condition {
        description
            "The purpose of this Class is to represent packet MAC
            packet header information that can be used as part of
            a test to determine if the set of Policy Actions in
            this ECA Policy Rule should be execute or not.";

        leaf-list pkt-sec-cond-mac-dest {
            type yang:phys-address;
            description
                "The MAC destination address (6 octets long).";
        }

        leaf-list pkt-sec-cond-mac-src {
            type yang:phys-address;
            description
                "The MAC source address (6 octets long).";
        }

        leaf-list pkt-sec-cond-mac-8021q {
            type string;
            description
                "This is an optional string attribute, and defines
                The 802.1Q tag value (2 octets long).";
        }

        leaf-list pkt-sec-cond-mac-ether-type {
            type string;
            description
                "The EtherType field (2 octets long). Values up to
                and including 1500 indicate the size of the
                payload in octets; values of 1536 and above
                define which protocol is encapsulated in the
                payload of the frame.";
        }

        leaf-list pkt-sec-cond-mac-tci {
            type string;
            description
                "This is an optional string attribute, and defines
                the Tag Control Information. This consists of a 3
                bit user priority field, a drop eligible indicator
                (1 bit), and a VLAN identifier (12 bits).";
        }
    }
}
```

```
}

container packet-security-ipv4-condition {
  description
    "The purpose of this Class is to represent IPv4
    packet header information that can be used as
    part of a test to determine if the set of Policy
    Actions in this ECA Policy Rule should be executed
    or not.";

  leaf-list pkt-sec-cond-ipv4-header-length {
    type uint8;
    description
      "The IPv4 packet header consists of 14 fields,
      of which 13 are required.";
  }

  leaf-list pkt-sec-cond-ipv4-tos {
    type uint8;
    description
      "The ToS field could specify a datagram's priority
      and request a route for low-delay,
      high-throughput, or highly-reliable service..";
  }

  leaf-list pkt-sec-cond-ipv4-total-length {
    type uint16;
    description
      "This 16-bit field defines the entire packet size,
      including header and data, in bytes.";
  }

  leaf-list pkt-sec-cond-ipv4-id {
    type uint8;
    description
      "This field is an identification field and is
      primarily used for uniquely identifying
      the group of fragments of a single IP datagram.";
  }

  leaf-list pkt-sec-cond-ipv4-fragment {
    type uint8;
    description
      "IP fragmentation is an Internet Protocol (IP)
      process that breaks datagrams into smaller pieces
      (fragments), so that packets may be formed that
      can pass through a link with a smaller maximum
      transmission unit (MTU) than the original
```

```
        datagram size.";
    }

    leaf-list pkt-sec-cond-ipv4-fragment-offset {
        type uint16;
        description
            "Fragment offset field along with Don't Fragment
            and More Fragment flags in the IP protocol
            header are used for fragmentation and reassembly
            of IP datagrams.";
    }

    leaf-list pkt-sec-cond-ipv4-ttl {
        type uint8;
        description
            "The ttl keyword is used to check for a specific
            IP time-to-live value in the header of
            a packet.";
    }

    leaf-list pkt-sec-cond-ipv4-protocol {
        type uint8;
        description
            "Internet Protocol version 4(IPv4) is the fourth
            version of the Internet Protocol (IP).";
    }

    leaf-list pkt-sec-cond-ipv4-src {
        type inet:ipv4-address;
        description
            "Defines the IPv4 Source Address.";
    }

    leaf-list pkt-sec-cond-ipv4-dest {
        type inet:ipv4-address;
        description
            "Defines the IPv4 Destination Address.";
    }

    leaf pkt-sec-cond-ipv4-ipopts {
        type string;
        description
            "With the ipopts keyword you can check if
            a specific ip option is set. Ipopts has
            to be used at the beginning of a rule.";
    }

    leaf pkt-sec-cond-ipv4-sameip {
```

```
    type boolean;
    description
      "Every packet has a source IP-address and
      a destination IP-address. It can be that
      the source IP is the same as
      the destination IP.";
  }

  leaf-list pkt-sec-cond-ipv4-geoip {
    type string;
    description
      "The geoip keyword enables you to match on
      the source, destination or source and destination
      IP addresses of network traffic and to see to
      which country it belongs. To do this, Suricata
      uses GeoIP API with MaxMind database format.";
  }
}

container packet-security-ipv6-condition {
  description
    "The purpose of this Class is to represent packet
    IPv6 packet header information that can be used as
    part of a test to determine if the set of Policy
    Actions in this ECA Policy Rule should be executed
    or not.";

  leaf-list pkt-sec-cond-ipv6-dscp {
    type string;
    description
      "Differentiated Services Code Point (DSCP)
      of ipv6.";
  }

  leaf-list pkt-sec-cond-ipv6-ecn {
    type string;
    description
      "ECN allows end-to-end notification of network
      congestion without dropping packets.";
  }

  leaf-list pkt-sec-cond-ipv6-traffic-class {
    type uint8;
    description
      "The bits of this field hold two values. The 6
      most-significant bits are used for
      differentiated services, which is used to
      classify packets.";
```

```
    }

    leaf-list pkt-sec-cond-ipv6-flow-label {
        type uint32;
        description
            "The flow label when set to a non-zero value
            serves as a hint to routers and switches
            with multiple outbound paths that these
            packets should stay on the same path so that
            they will not be reordered.";
    }

    leaf-list pkt-sec-cond-ipv6-payload-length {
        type uint16;
        description
            "The size of the payload in octets,
            including any extension headers.";
    }

    leaf-list pkt-sec-cond-ipv6-next-header {
        type uint8;
        description
            "Specifies the type of the next header.
            This field usually specifies the transport
            layer protocol used by a packet's payload.";
    }

    leaf-list pkt-sec-cond-ipv6-hop-limit {
        type uint8;
        description
            "Replaces the time to live field of IPv4.";
    }

    leaf-list pkt-sec-cond-ipv6-src {
        type inet:ipv6-address;
        description
            "The IPv6 address of the sending node.";
    }

    leaf-list pkt-sec-cond-ipv6-dest {
        type inet:ipv6-address;
        description
            "The IPv6 address of the destination node(s).";
    }
}

container packet-security-tcp-condition {
    description
```

```
"The purpose of this Class is to represent packet
TCP packet header information that can be used as
part of a test to determine if the set of Policy
Actions in this ECA Policy Rule should be executed
or not.";

leaf-list pkt-sec-cond-tcp-seq-num {
  type uint32;
  description
    "If the SYN flag is set (1), then this is the
    initial sequence number.";
}

leaf-list pkt-sec-cond-tcp-ack-num {
  type uint32;
  description
    "If the ACK flag is set then the value of this
    field is the next sequence number that the sender
    is expecting.";
}

leaf-list pkt-sec-cond-tcp-window-size {
  type uint16;
  description
    "The size of the receive window, which specifies
    the number of windows size units
    (by default,bytes) (beyond the segment
    identified by the sequence number in the
    acknowledgment field) that the sender of this
    segment is currently willing to receive.";
}

leaf-list pkt-sec-cond-tcp-flags {
  type uint8;
  description
    "This is a mandatory string attribute, and defines
    the nine Control bit flags (9 bits).";
}
}

container packet-security-udp-condition {
  description
    "The purpose of this Class is to represent packet UDP
    packet header information that can be used as part
    of a test to determine if the set of Policy Actions
    in this ECA Policy Rule should be executed or not.";

  leaf-list pkt-sec-cond-udp-length {
```

```
        type string;
        description
            "This is a mandatory string attribute, and defines
            the length in bytes of the UDP header and data
            (16 bits).";
    }
}

container packet-security-icmp-condition {
    description
        "The internet control message protocol condition.";

    leaf-list pkt-sec-cond-icmp-type {
        type uint8;
        description
            "ICMP type, see Control messages.";
    }

    leaf-list pkt-sec-cond-icmp-code {
        type uint8;
        description
            "ICMP subtype, see Control messages.";
    }

    leaf-list pkt-sec-cond-icmp-seg-num {
        type uint32;
        description
            "The icmp Sequence Number.";
    }
}

case packet-payload-condition {
    leaf packet-payload-manual {
        type string;
        description
            "This is manual for payload condition.
            Vendors can write instructions for payload condition
            that vendor made";
    }
    leaf-list pkt-payload-content {
        type string;
        description
            "The content keyword is very important in
            signatures. Between the quotation marks you
            can write on what you would like the
            signature to match.";
    }
}
```

```
}
case target-condition {
  leaf target-manual {
    type string;
    description
      "This is manual for target condition.
      Vendors can write instructions for target condition
      that vendor made";
  }

  container device-sec-context-cond {
    description
      "The device attribute that can identify a device,
      including the device type (i.e., router, switch,
      pc, ios, or android) and the device's owner as
      well.";

    leaf pc {
      type boolean;
      description
        "If type of a device is PC.";
    }

    leaf mobile-phone {
      type boolean;
      description
        "If type of a device is mobile-phone.";
    }

    leaf voip-volte-phone {
      type boolean;
      description
        "If type of a device is voip-volte-phone.";
    }

    leaf tablet {
      type boolean;
      description
        "If type of a device is tablet.";
    }

    leaf iot {
      type boolean;
      description
        "If type of a device is Internet of Things.";
    }
  }
}
```

```
        leaf vehicle {
            type boolean;
            description
                "If type of a device is vehicle.";
        }
    }
}
case users-condition {
    leaf users-manual {
        type string;
        description
            "This is manual for user condition.
            Vendors can write instructions for user condition
            that vendor made";
    }
}

container user{
    description
        "The user (or user group) information with which
        network flow is associated: The user has many
        attributes such as name, id, password, type,
        authentication mode and so on. Name/id is often
        used in the security policy to identify the user.
        Besides, NSF is aware of the IP address of the
        user provided by a unified user management system
        via network. Based on name-address association,
        NSF is able to enforce the security functions
        over the given user (or user group)";

    choice user-name {
        description
            "The name of the user.
            This must be unique.";

        case tenant {
            description
                "Tenant information.";

            leaf tenant {
                type uint8;
                mandatory true;
                description
                    "User's tenant information.";
            }
        }

        case vn-id {
            description
```

```
        "VN-ID information.";

        leaf vn-id {
            type uint8;
            mandatory true;
            description
                "User's VN-ID information.";
        }
    }
}

container group {
    description
        "The user (or user group) information with which
        network flow is associated: The user has many
        attributes such as name, id, password, type,
        authentication mode and so on. Name/id is often
        used in the security policy to identify the user.
        Besides, NSF is aware of the IP address of the
        user provided by a unified user management system
        via network. Based on name-address association,
        NSF is able to enforce the security functions
        over the given user (or user group)";

    choice group-name {
        description
            "The name of the user.
            This must be unique.";

        case tenant {
            description
                "Tenant information.";

            leaf tenant {
                type uint8;
                mandatory true;
                description
                    "User's tenant information.";
            }
        }

        case vn-id {
            description
                "VN-ID information.";

            leaf vn-id {
                type uint8;
                mandatory true;
            }
        }
    }
}
```

```
        description
            "User's VN-ID information.";
    }
}
}

case context-condition {
    leaf context-manual {
        type string;
        description
            "This is manual for context condition.
            Vendors can write instructions for context condition
            that vendor made";
    }
}
case gen-context-condition {
    leaf gen-context-manual {
        type string;
        description
            "This is manual for generic context condition.
            Vendors can write instructions for generic context
            condition that vendor made";
    }
}

container geographic-location {
    description
        "The location where network traffic is associated
        with. The region can be the geographic location
        such as country, province, and city,
        as well as the logical network location such as
        IP address, network section, and network domain.";

    leaf-list src-geographic-location {
        type uint32;
        description
            "This is mapped to ip address. We can acquire
            source region through ip address stored the
            database.";
    }
    leaf-list dest-geographic-location {
        type uint32;
        description
            "This is mapped to ip address. We can acquire
            destination region through ip address stored
            the database.";
    }
}
```

```

    }
  }
}
}
container action-clause-container {
  description "TBD";
  list action-clause-list {
    key eca-object-id;
    uses i2nsf-eca-object-type {
      refine entity-class {
        default ECA-ACTION-TYPE;
      }
    }
  }
}
description
  "An action is used to control and monitor aspects of
  flow-based NSFs when the event and condition clauses
  are satisfied. NSFs provide security functions by
  executing various Actions. Examples of I2NSF Actions
  include providing intrusion detection and/or protection,
  web and flow filtering, and deep packet inspection
  for packets and flows.";

choice action-type {
  description
    "Vendors can use YANG data model to configure rules
    by concreting this action type";
  case ingress-action {
    leaf ingress-manual {
      type string;
      description
        "This is manual for ingress action.
        Vendors can write instructions for ingress action
        that vendor made";
    }
    leaf ingress-action-type {
      type ingress-action;
      description
        "Ingress action type: permit, deny, and mirror.";
    }
  }
  case egress-action {
    leaf egress-manual {
      type string;
      description
        "This is manual for egress action.
        Vendors can write instructions for egress action

```

```
        that vendor made";
    }
    leaf egress-action-type {
        type egress-action;
        description
            "Egress-action-type: invoke-signaling,
            tunnel-encapsulation, and forwarding.";
    }
}
case apply-profile {
    leaf profile-manual {
        type string;
        description
            "This is manual for apply profile action.
            Vendors can write instructions for apply
            profile action that vendor made";
    }

    choice apply-profile-action-type {
        description
            "Advanced action types: Content Security Control
            and Attack Mitigation Control.";

        case content-security-control {
            description
                "Content security control is another category of
                security capabilities applied to application layer.
                Through detecting the contents carried over the
                traffic in application layer, these capabilities
                can realize various security purposes, such as
                defending against intrusion, inspecting virus,
                filtering malicious URL or junk email, and blocking
                illegal web access or data retrieval.";

            container content-security-control-types {
                description
                    "Content Security types: Antivirus, IPS, IDS,
                    url-filtering, data-filtering, mail-filtering,
                    file-blocking, file-isolate, pkt-capture,
                    application-control, and voip-volte.";

                leaf antivirus {
                    type boolean;
                    description
                        "Additional inspection of antivirus.";
                }

                leaf ips {
```

```
        type boolean;
        description
            "Additional inspection of IPS.";
    }

    leaf ids {
        type boolean;
        description
            "Additional inspection of IDS.";
    }

    leaf url-filtering {
        type boolean;
        description
            "Additional inspection of URL filtering.";
    }

    leaf data-filtering {
        type boolean;
        description
            "Additional inspection of data filtering.";
    }

    leaf mail-filtering {
        type boolean;
        description
            "Additional inspection of mail filtering.";
    }

    leaf file-blocking {
        type boolean;
        description
            "Additional inspection of file blocking.";
    }

    leaf file-isolate {
        type boolean;
        description
            "Additional inspection of file isolate.";
    }

    leaf pkt-capture {
        type boolean;
        description
            "Additional inspection of packet capture.";
    }

    leaf application-control {
```

```
        type boolean;
        description
            "Additional inspection of app control.";
    }

    leaf voip-volte {
        type boolean;
        description
            "Additional inspection of VoIP/VoLTE.";
    }
}

case attack-mitigation-control {
    description
        "This category of security capabilities is
        specially used to detect and mitigate various
        types of network attacks.";

    choice attack-mitigation-control-type {
        description
            "Attack-mitigation types: DDoS-attack and
            Single-packet attack.";

        case ddos-attack {
            description
                "A distributed-denial-of-service (DDoS) is
                where the attack source is more than one,
                often thousands of unique IP addresses.";

            container ddos-attack-type {
                description
                    "DDoS-attack types: Network Layer
                    DDoS Attacks and Application Layer
                    DDoS Attacks.";

                container network-layer-ddos-attack {
                    description
                        "Network layer DDoS-attack.";
                    container network-layer-ddos-attack-type {
                        description
                            "Network layer DDoS attack types:
                            Syn Flood Attack, UDP Flood Attack,
                            ICMP Flood Attack, IP Fragment Flood,
                            IPv6 Related Attacks, and etc";

                            leaf syn-flood {
                                type boolean;
                            }
                        }
                    }
                }
            }
        }
    }
}
```

```
        description
            "Additional Inspection of
             Syn Flood Attack.";
    }

    leaf udp-flood {
        type boolean;
        description
            "Additional Inspection of
             UDP Flood Attack.";
    }

    leaf icmp-flood {
        type boolean;
        description
            "Additional Inspection of
             ICMP Flood Attack.";
    }

    leaf ip-frag-flood {
        type boolean;
        description
            "Additional Inspection of
             IP Fragment Flood.";
    }

    leaf ipv6-related {
        type boolean;
        description
            "Additional Inspection of
             IPv6 Related Attacks.";
    }
}

container app-layer-ddos-attack {
    description
        "Application layer DDoS-attack.";

    container app-ddos-attack-types {
        description
            "Application layer DDoS-attack types:
             Http Flood Attack, Https Flood Attack,
             DNS Flood Attack, and
             DNS Amplification Flood Attack,
             SSL DDoS Attack, and etc.";

        leaf http-flood {
```

```

        type boolean;
        description
            "Additional Inspection of
            Http Flood Attack.";
    }

    leaf https-flood {
        type boolean;
        description
            "Additional Inspection of
            Https Flood Attack.";
    }

    leaf dns-flood {
        type boolean;
        description
            "Additional Inspection of
            DNS Flood Attack.";
    }

    leaf dns-amp-flood {
        type boolean;
        description
            "Additional Inspection of
            DNS Amplification Flood Attack.";
    }

    leaf ssl-ddos {
        type boolean;
        description
            "Additional Inspection of
            SSL Flood Attack.";
    }
}
}
}

case single-packet-attack {
    description
        "Single Packet Attacks.";
    container single-packet-attack-type {
        description
            "DDoS-attack types: Scanning Attack,
            Sniffing Attack, Malformed Packet Attack,
            Special Packet Attack, and etc.";

        container scan-and-sniff-attack {

```

```
description
  "Scanning and Sniffing Attack.";
container scan-and-sniff-attack-types {
  description
    "Scanning and sniffing attack types:
     IP Sweep attack, Port Scanning,
     and etc.";

  leaf ip-sweep {
    type boolean;
    description
      "Additional Inspection of
       IP Sweep Attack.";
  }

  leaf port-scanning {
    type boolean;
    description
      "Additional Inspection of
       Port Scanning Attack.";
  }
}

container malformed-packet-attack {
  description
    "Malformed Packet Attack.";
  container malformed-packet-attack-types {
    description
      "Malformed packet attack types:
       Ping of Death Attack, Teardrop Attack,
       and etc.";

    leaf ping-of-death {
      type boolean;
      description
        "Additional Inspection of
         Ping of Death Attack.";
    }

    leaf teardrop {
      type boolean;
      description
        "Additional Inspection of
         Teardrop Attack.";
    }
  }
}
```

```

        container special-packet-attack {
            description
                "special Packet Attack.";
            container special-packet-attack-types {
                description
                    "Special packet attack types:
                     Oversized ICMP Attack, Tracert Attack,
                     and etc.";

                leaf oversized-icmp {
                    type boolean;
                    description
                        "Additional Inspection of
                         Overage ICMP Attack.";
                }

                leaf tracert {
                    type boolean;
                    description
                        "Additional Inspection of
                         Tracrt Attack.";
                }
            }
        }
    }
}

```

<CODE ENDS>

This document introduces no additional security threats and SHOULD follow the security requirements as stated in [i2nsf-framework].

8. Acknowledgments

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9. Contributors

I2NSF is a group effort. I2NSF has had a number of contributing authors. The following are considered co-authors:

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Appendix A. draft-kim-i2nsf-nsf-facing-interface-data-model-03

The following changes are made from draft-kim-i2nsf-nsf-facing-interface-data-model-03:

1. Event/Condition/Action Policies are changed to Event/Condition/Action Clauses.
2. Resolution Strategy mechanism is added to specify how to resolve conflicts that occur between the actions of the same or different policy rules that are matched and contained in this particular NSF.
3. Default Action mechanism is added to specify a predefined action when no other alternative action was matched by the currently executing I2NSF Policy Rule.
4. Introduction stating is added that the data model structure can be mapped to draft-ietf-i2nsf-capability.
5. Identities are added for combining the overlaped attributes as one "Identity" so that only one "Identity" is appearing.
6. Aggregations for Event, Condition, and Action Object are added for reusing the objects.

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