# I2NSF YANG Data Models

draft-ietf-i2nsf-capability-data-model-04
draft-ietf-i2nsf-consumer-facing-interface-dm-03
draft-ietf-i2nsf-nsf-facing-interface-dm-04
draft-ietf-i2nsf-registration-interface-dm-03
draft-ietf-i2nsf-nsf-monitoring-data-model-00

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Jaehoon Paul Jeong
pauljeong@skku.edu
Sungkyunkwan University

# WG Documents of YANG Data Models

- Information Model Draft on NSF Capabilities
  - draft-ietf-i2nsf-capabilities-04
- Base YANG Data Model Draft
  - draft-ietf-i2nsf-capability-data-model-04
- I2NSF Interface YANG Data Model Drafts
  - draft-ietf-i2nsf-consumer-facing-interface-dm-03
  - draft-ietf-i2nsf-nsf-facing-interface-dm-04
  - draft-ietf-i2nsf-registration-interface-dm-03
  - draft-ietf-i2nsf-nsf-monitoring-data-model-00
- Verification of those YANG Data Models
  - Those will be verified through the 8 IETF Hackathons (IETF 97 ~ IETF 104).

# Updates from the Previous Versions

- Consistency with **NSF Capabilities Information Model**
  - draft-ietf-i2nsf-capabilities-04

- Revision of YANG data modules according to YANG guidelines (RFC 6087)

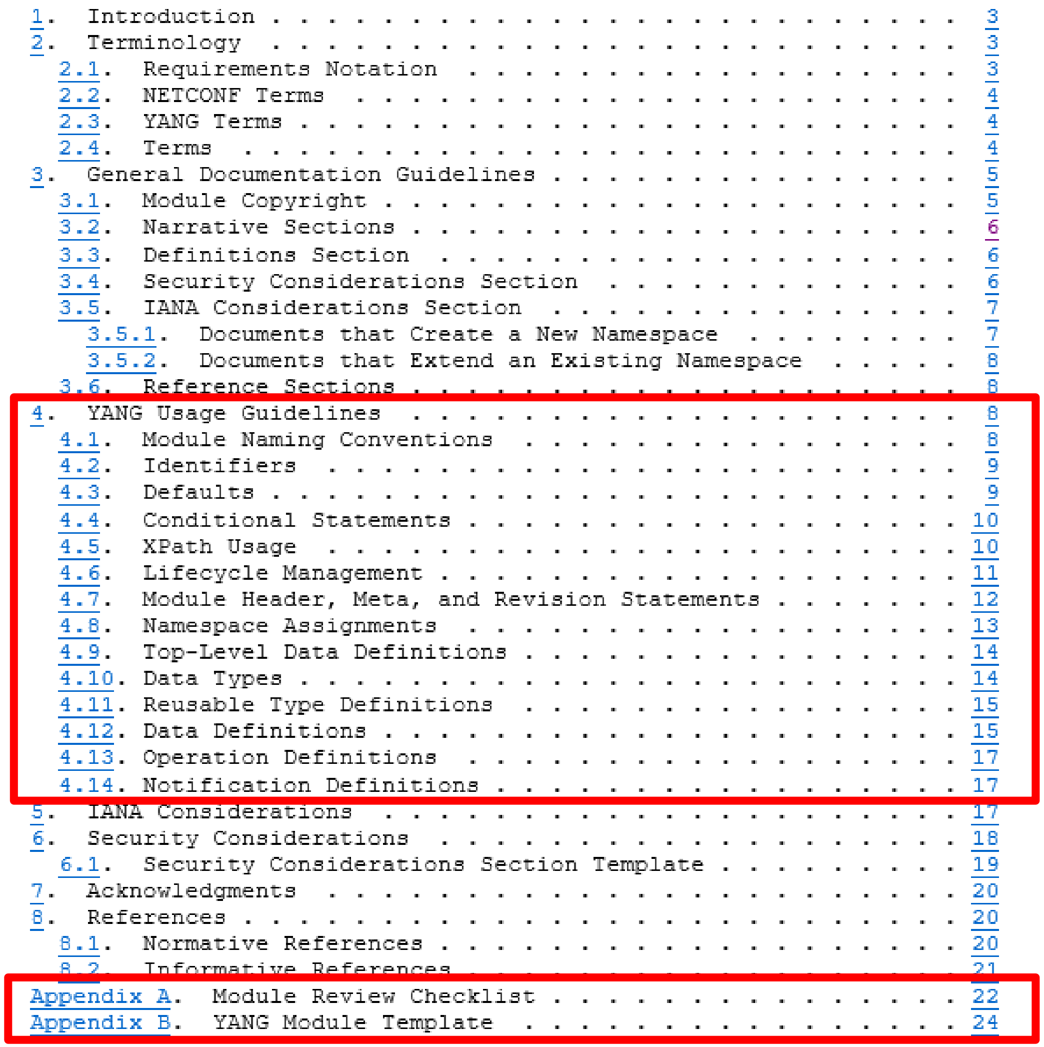
- Synchronization among Data Models of I2NSF Interfaces
  - NSF Capability
  - Consumer-Facing Interface
  - NSF-Facing Interface
  - Registration Interface
  - NSF Monitoring

- XML Files for Three Kinds of Security Services
  - Network Security: Firewall, Time-based Firewall
  - Contents Security: Web Filter, VoIP/VoLTE Security
  - Attack Mitigation Security: HTTP(S) Flood-Attack Mitigator

# Updates of Capability Data Model (DM)

- Consistency with NSF Capabilities Information Model
  - draft-ietf-i2nsf-capabilities-04
- Relationship with Other YANG Data Models
  - draft-ietf-i2nsf-consumer-facing-interface-dm-03
  - draft-ietf-i2nsf-nsf-facing-interface-dm-04
  - draft-hyun-i2nsf-registration-interface-dm-03
- Revision of YANG Data Module according to Guidelines in RFC 6087
- Restructure of the Overall YANG Data Module

# Revision of YANG Data Module according to Guidelines in RFC 6087



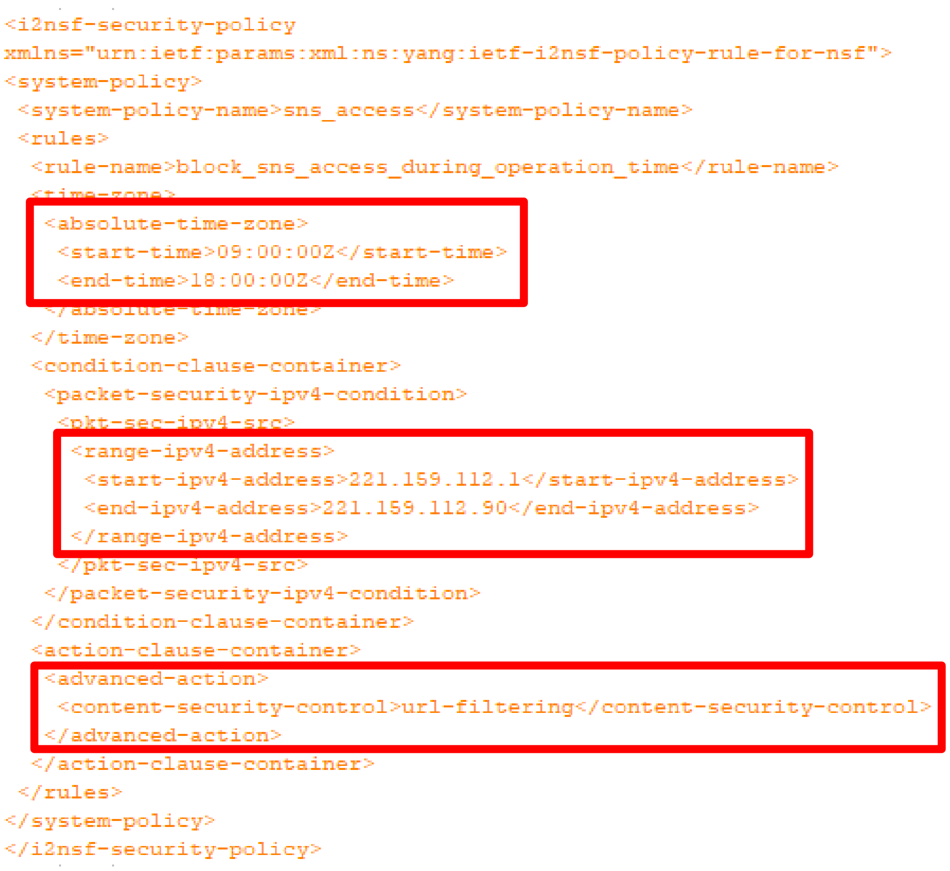
# Updates of NSF-Facing Interface DM

- Consistency with NSF Capabilities Information Model
  - draft-ietf-i2nsf-capabilities-04
- Revision of YANG Data Module according to Guidelines in  RFC 6087
- Addition of Exact Match Type and Range Match Type
- Addition of Configuration XML Examples
  - Scenario 1 - Block SNS access during business hours
  - Scenario 2 - Block malicious VoIP/VoLTE packets coming to the company
  - Scenario 3 - Mitigate HTTP and HTTPS flood attacks on a company web Server

# Addition of Configuration XML Examples

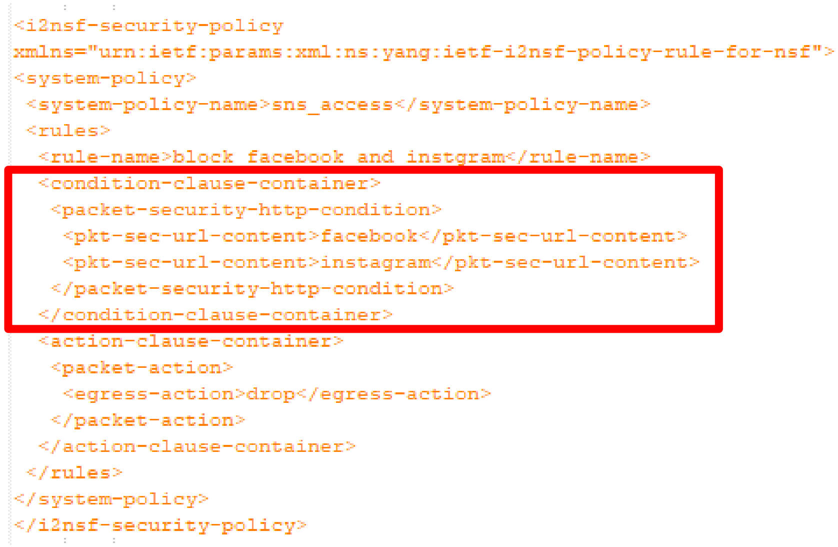
**Security Service:** Block SNS Access during Business Hours

### Time-based Firewall



```
<i2nsf-security-policy
xmlns="urn:ietf:params:xml:ns:yang:ietf-i2nsf-policy-rule-for-nsf">
<system-policy>
 <system-policy-name>sns_access</system-policy-name>
 <rules>
  <rule-name>block_sns_access_during_operation_time</rule-name>
  <time-zone>
   <absolute-time-zone>
    <start-time>09:00:00Z</start-time>
    <end-time>18:00:00Z</end-time>
   </absolute-time-zone>
  </time-zone>
  <condition-clause-container>
   <packet-security-ipv4-condition>
    <pkt-sec-ipv4-src>
     <range-ipv4-address>
      <start-ipv4-address>221.159.112.1</start-ipv4-address>
      <end-ipv4-address>221.159.112.90</end-ipv4-address>
     </range-ipv4-address>
    </pkt-sec-ipv4-src>
   </packet-security-ipv4-condition>
  </condition-clause-container>
  <action-clause-container>
   <advanced-action>
    <content-security-control>url-filtering</content-security-control>
   </advanced-action>
  </action-clause-container>
 </rules>
</system-policy>
</i2nsf-security-policy>
```

### Web Filter



```
<i2nsf-security-policy
xmlns="urn:ietf:params:xml:ns:yang:ietf-i2nsf-policy-rule-for-nsf">
<system-policy>
 <system-policy-name>sns_access</system-policy-name>
 <rules>
  <rule-name>block facebook and instgram</rule-name>
  <condition-clause-container>
   <packet-security-http-condition>
    <pkt-sec-url-content>facebook</pkt-sec-url-content>
    <pkt-sec-url-content>instagram</pkt-sec-url-content>
   </packet-security-http-condition>
  </condition-clause-container>
  <action-clause-container>
   <packet-action>
    <egress-action>drop</egress-action>
   </packet-action>
  </action-clause-container>
 </rules>
</system-policy>
</i2nsf-security-policy>
```

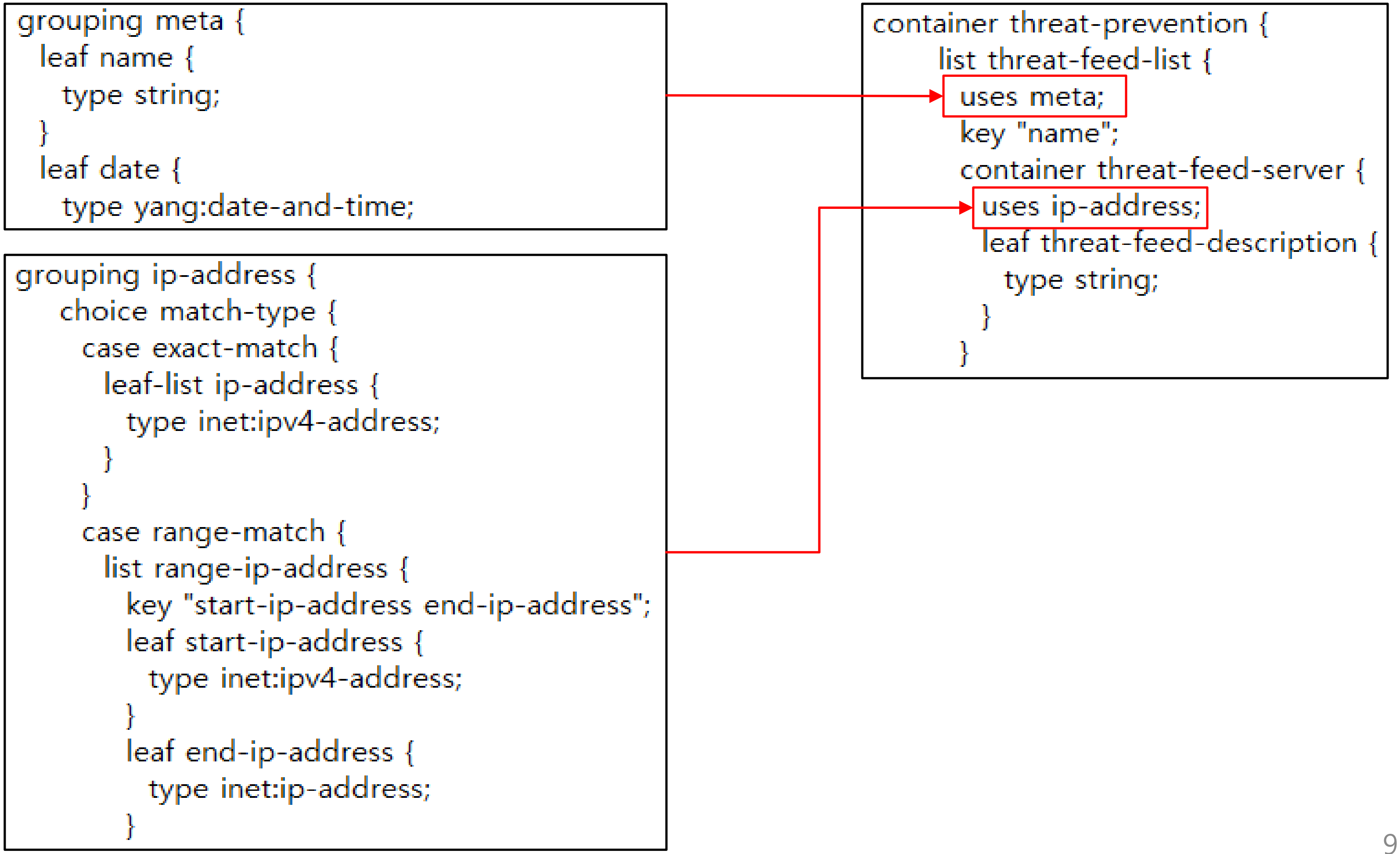
# Updates of Consumer-Facing Interface DM

- Merging the information model & data model:
  - draft-ietf-i2nsf-consumer-facing-interface-dm-02
  - draft-kumar-i2nsf-client-facing-interface-im-06

- Changes are as follows:
  - More detailed information about each object in DM
  - Grouping is used to group repeated parts in DM
  - DM more generic for various security services

# Updates: Grouping

- Grouping to group the repeated parts of the data model.
  - Recurring fields (e.g., “name” and “date”) are grouped as “meta”.



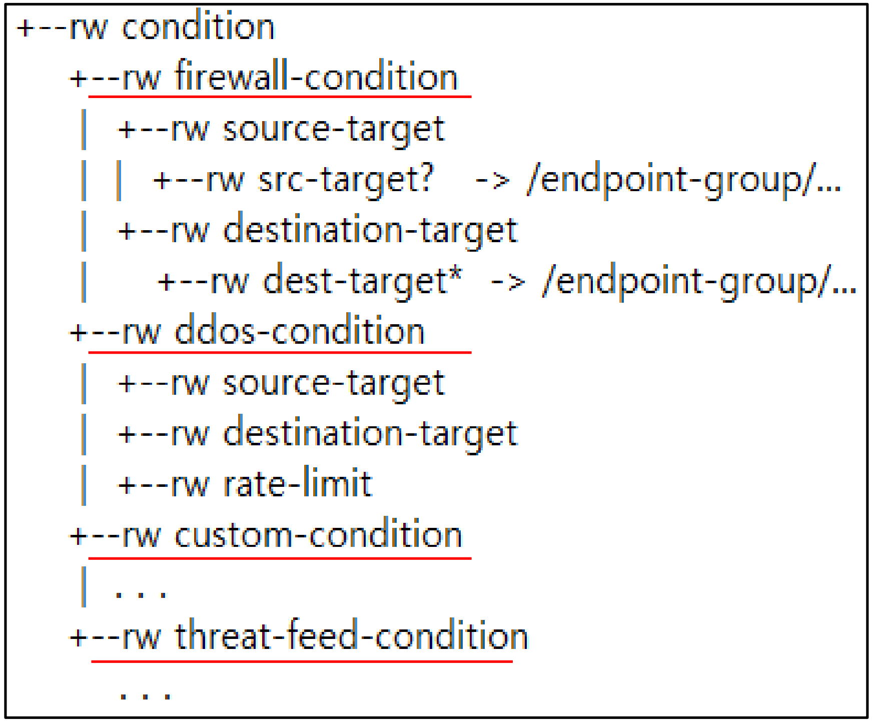
```
grouping meta {
  leaf name {
    type string;
  }
  leaf date {
    type yang:date-and-time;
```

```
grouping ip-address {
    choice match-type {
      case exact-match {
        leaf-list ip-address {
          type inet:ipv4-address;
        }
      }
      case range-match {
        list range-ip-address {
          key "start-ip-address end-ip-address";
          leaf start-ip-address {
            type inet:ipv4-address;
          }
          leaf end-ip-address {
            type inet:ip-address;
          }
```

```
container threat-prevention {
      list threat-feed-list {
        uses meta;
        key "name";
        container threat-feed-server {
          uses ip-address;
          leaf threat-feed-description {
            type string;
          }
        }
```

# Updates: Generic Data Model

- A generic data model is provided.
  - A condition object can cover most of the firewall, DPI, DDoS-mitigation cases.



```
+--rw condition
   +--rw firewall-condition
   |  +--rw source-target
   |  |  +--rw src-target?   -> /endpoint-group/...
   |  +--rw destination-target
   |     +--rw dest-target*   -> /endpoint-group/...
   +--rw ddos-condition
   |  +--rw source-target
   |  +--rw destination-target
   |  +--rw rate-limit
   +--rw custom-condition
   |  . . .
   +--rw threat-feed-condition
      . . .
```

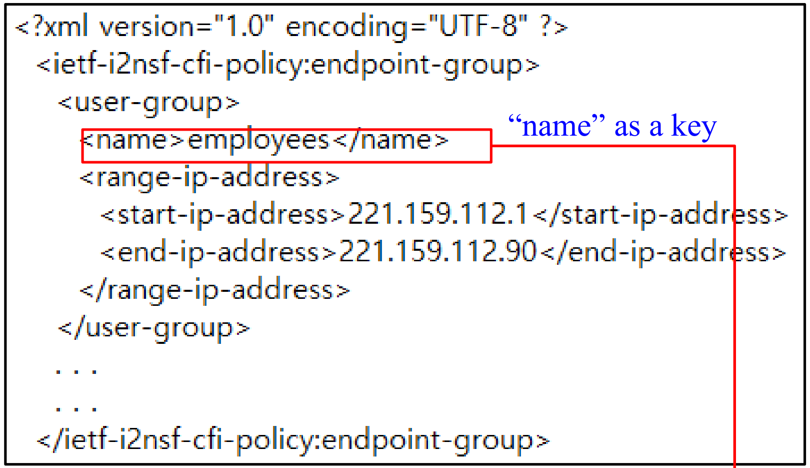
Flexible Conditions:

- The condition object can flexibly cover general network security services.
- Custom-condition can cover DPI which inspects a packet’s payload.
- Threat-feed-condition can consider file types and signature information.

# Addition of Configuration XML Examples

**Security Service:** Block SNS Access during Business Hours

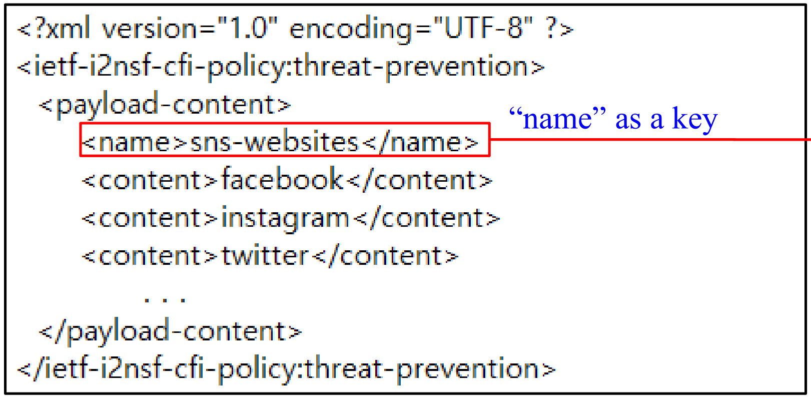
## Registered User Group



```
<?xml version="1.0" encoding="UTF-8" ?>
  <ietf-i2nsf-cfi-policy:endpoint-group>
    <user-group>
      <name>employees</name>
      <range-ip-address>
        <start-ip-address>221.159.112.1</start-ip-address>
        <end-ip-address>221.159.112.90</end-ip-address>
      </range-ip-address>
    </user-group>
    . . .
    . . .
  </ietf-i2nsf-cfi-policy:endpoint-group>
```

“name” as a key

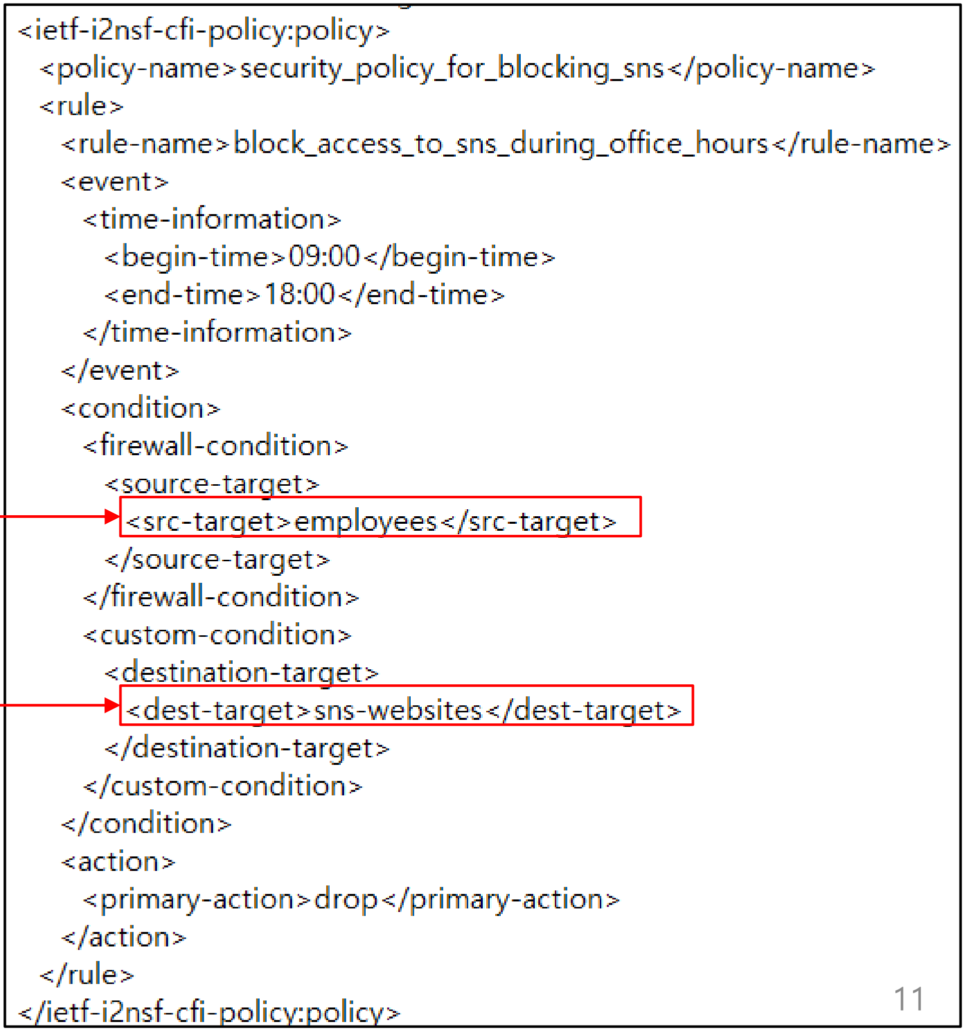
## Registered Payload Content



```
<?xml version="1.0" encoding="UTF-8" ?>
<ietf-i2nsf-cfi-policy:threat-prevention>
  <payload-content>
    <name>sns-websites</name>
    <content>facebook</content>
    <content>instagram</content>
    <content>twitter</content>
          . . .
  </payload-content>
</ietf-i2nsf-cfi-policy:threat-prevention>
```

“name” as a key

## Generated Security Policy



```
<ietf-i2nsf-cfi-policy:policy>
  <policy-name>security_policy_for_blocking_sns</policy-name>
  <rule>
    <rule-name>block_access_to_sns_during_office_hours</rule-name>
    <event>
      <time-information>
        <begin-time>09:00</begin-time>
        <end-time>18:00</end-time>
      </time-information>
    </event>
    <condition>
      <firewall-condition>
        <source-target>
          <src-target>employees</src-target>
        </source-target>
      </firewall-condition>
      <custom-condition>
        <destination-target>
          <dest-target>sns-websites</dest-target>
        </destination-target>
      </custom-condition>
    </condition>
    <action>
      <primary-action>drop</primary-action>
    </action>
  </rule>
</ietf-i2nsf-cfi-policy:policy>
```

# Updates of Registration Interface DM

- Clarification of Objectives of I2NSF Registration Interface
  - NSF Capability Registration
  - NSF Capability Query

- Revision of YANG Data Module according to Guidelines in RFC 6087

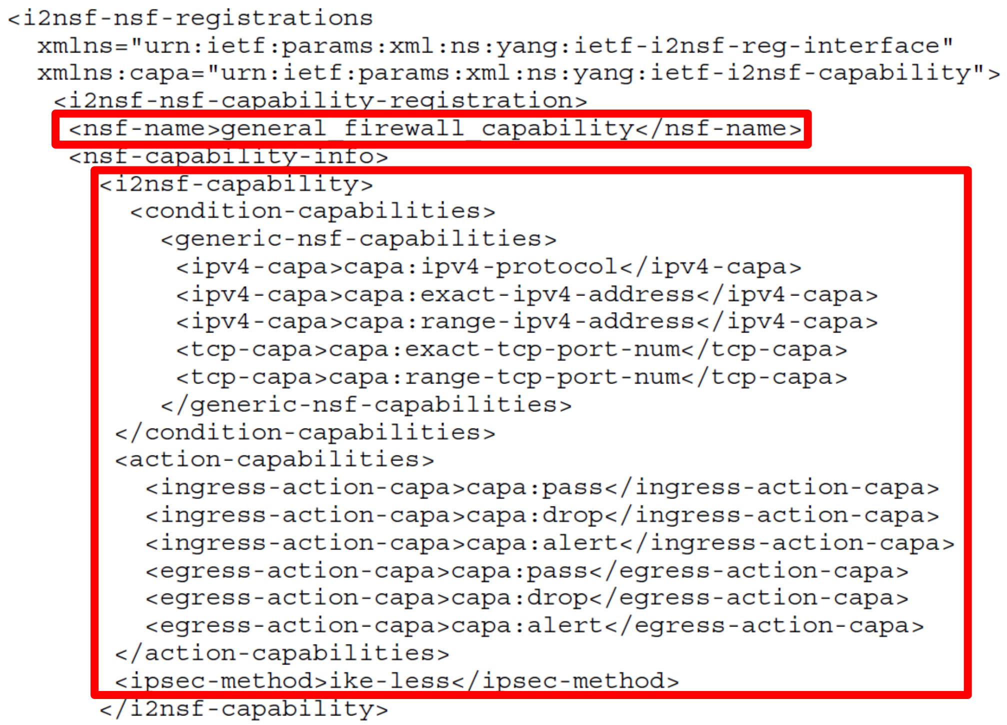
- Revision of the Overall YANG Data Module

- Addition of Description for YANG Tree Diagram

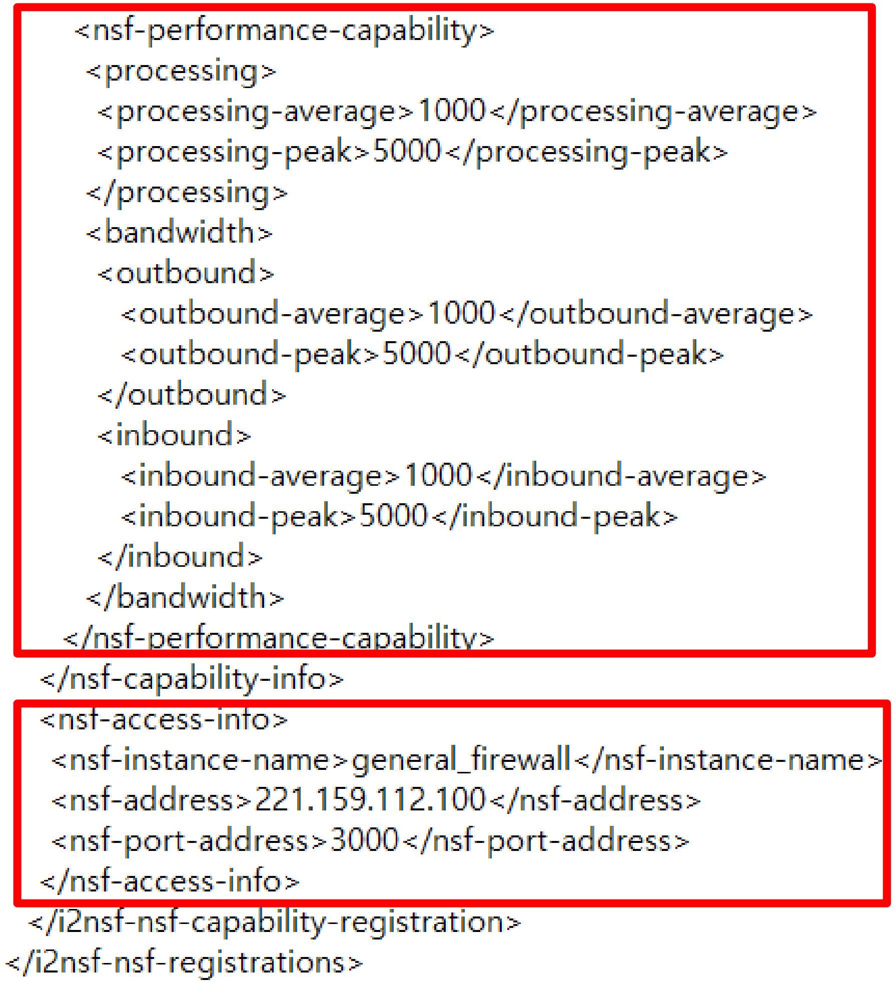
- Addition of Configuration XML Examples

# Addition of Configuration XML Examples

**Set-up Service:** Registration for Capabilities of a General Firewall



```
<i2nsf-nsf-registrations
  xmlns="urn:ietf:params:xml:ns:yang:ietf-i2nsf-reg-interface"
  xmlns:capa="urn:ietf:params:xml:ns:yang:ietf-i2nsf-capability">
   <i2nsf-nsf-capability-registration>
    <nsf-name>general_firewall_capability</nsf-name>
    <nsf-capability-info>
      <i2nsf-capability>
        <condition-capabilities>
          <generic-nsf-capabilities>
           <ipv4-capa>capa:ipv4-protocol</ipv4-capa>
           <ipv4-capa>capa:exact-ipv4-address</ipv4-capa>
           <ipv4-capa>capa:range-ipv4-address</ipv4-capa>
           <tcp-capa>capa:exact-tcp-port-num</tcp-capa>
           <tcp-capa>capa:range-tcp-port-num</tcp-capa>
          </generic-nsf-capabilities>
       </condition-capabilities>
       <action-capabilities>
         <ingress-action-capa>capa:pass</ingress-action-capa>
         <ingress-action-capa>capa:drop</ingress-action-capa>
         <ingress-action-capa>capa:alert</ingress-action-capa>
         <egress-action-capa>capa:pass</egress-action-capa>
         <egress-action-capa>capa:drop</egress-action-capa>
         <egress-action-capa>capa:alert</egress-action-capa>
       </action-capabilities>
       <ipsec-method>ike-less</ipsec-method>
      </i2nsf-capability>
```



```
      <nsf-performance-capability>
       <processing>
        <processing-average>1000</processing-average>
        <processing-peak>5000</processing-peak>
       </processing>
       <bandwidth>
        <outbound>
          <outbound-average>1000</outbound-average>
          <outbound-peak>5000</outbound-peak>
        </outbound>
        <inbound>
          <inbound-average>1000</inbound-average>
          <inbound-peak>5000</inbound-peak>
        </inbound>
       </bandwidth>
     </nsf-performance-capability>
   </nsf-capability-info>
   <nsf-access-info>
    <nsf-instance-name>general_firewall</nsf-instance-name>
    <nsf-address>221.159.112.100</nsf-address>
    <nsf-port-address>3000</nsf-port-address>
   </nsf-access-info>
  </i2nsf-nsf-capability-registration>
</i2nsf-nsf-registrations>
```

# Updates of NSF Monitoring DM

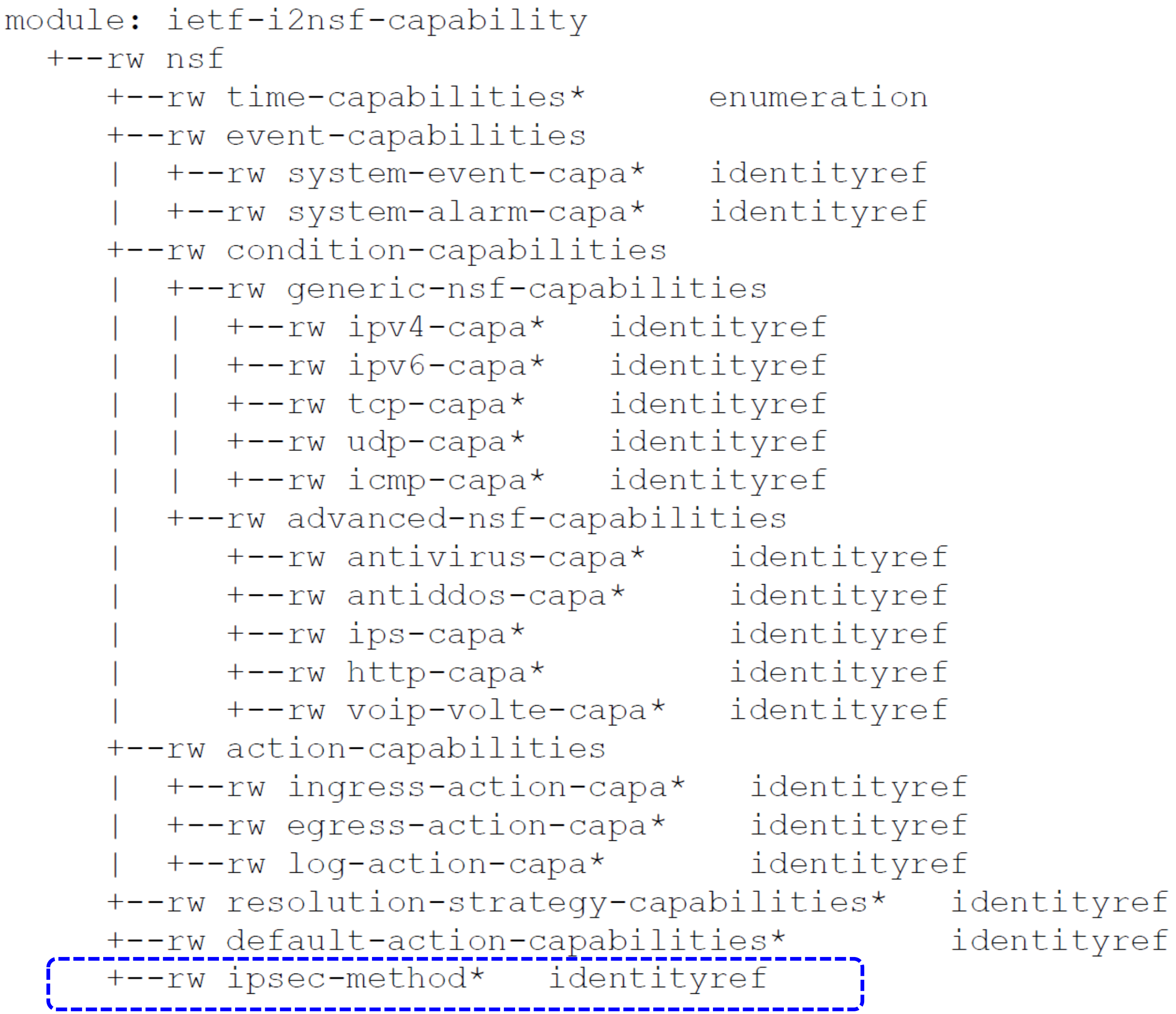
- Merging of NSF Monitoring Information Model and Data Model Drafts
  - draft-zhang-i2nsf-info-model-monitoring-07
  - draft-hong-i2nsf-nsf-monitoring-data-model-06
- Revision of YANG Data Module according to Guidelines in RFC 6087
- Revision of the Overall YANG Data Module
- Replacing enumeration type with identity type for scalable components
- Addition of Description for YANG Tree Diagram

# Data Model Convergence (1/3)

- **Motivation**
  - Fast Convergence among I2NSF Interface Data Models
  - Accommodation of a New Data Model such as I2NSF IKE/IPsec
- **Approach**
  - NSF Capability Data Model can have a reference to a concrete data model for a new capability such as I2NSF IKE/IPsec.
  - This approach is extensible for future capabilities.

# Data Model Convergence (2/3)

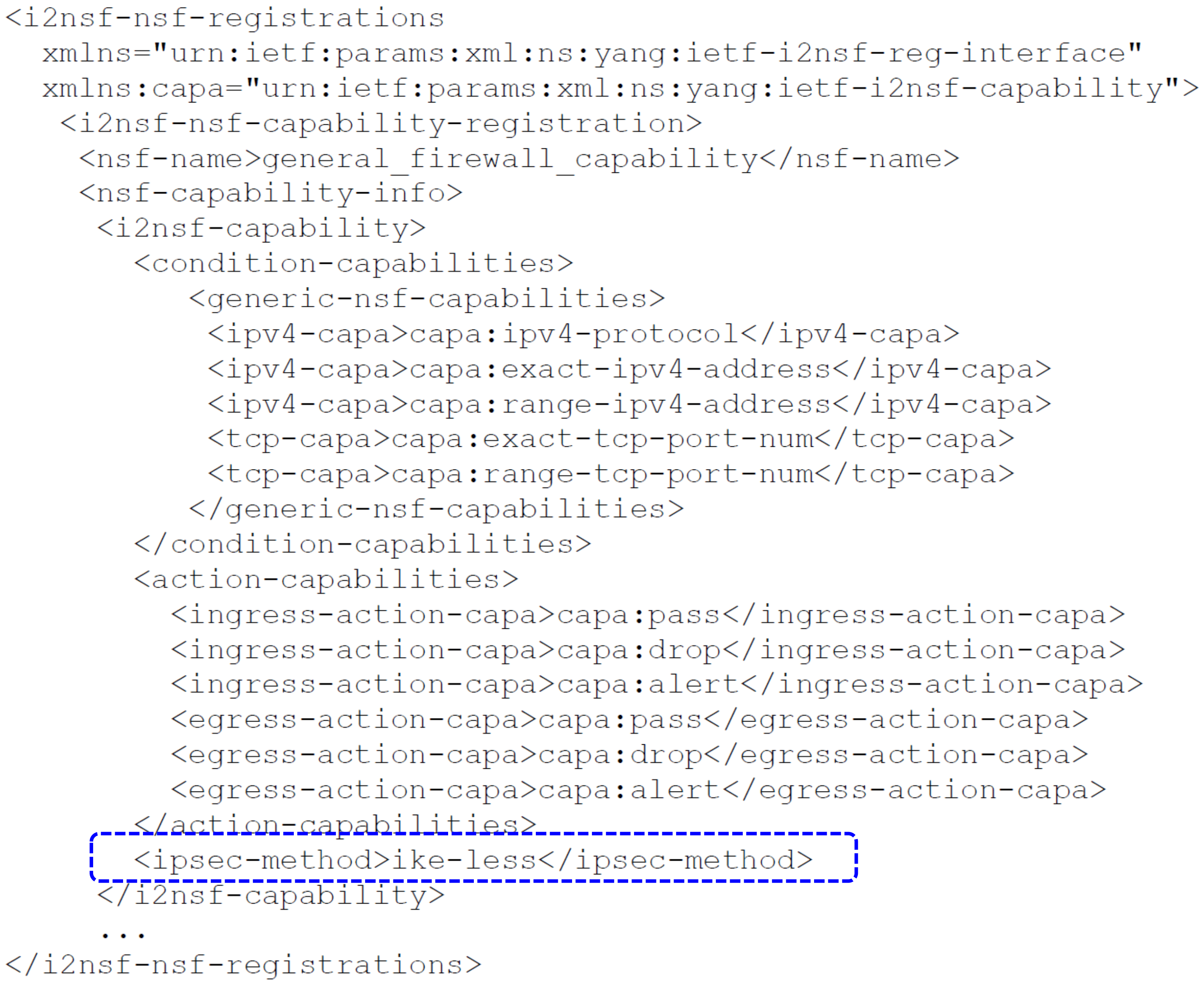
- **NSF Capability Data Model for I2NSF IKE/IPsec**



```
module: ietf-i2nsf-capability
  +--rw nsf
     +--rw time-capabilities*      enumeration
     +--rw event-capabilities
     |  +--rw system-event-capa*   identityref
     |  +--rw system-alarm-capa*   identityref
     +--rw condition-capabilities
     |  +--rw generic-nsf-capabilities
     |  |  +--rw ipv4-capa*   identityref
     |  |  +--rw ipv6-capa*   identityref
     |  |  +--rw tcp-capa*    identityref
     |  |  +--rw udp-capa*    identityref
     |  |  +--rw icmp-capa*   identityref
     |  +--rw advanced-nsf-capabilities
     |     +--rw antivirus-capa*    identityref
     |     +--rw antiddos-capa*     identityref
     |     +--rw ips-capa*          identityref
     |     +--rw http-capa*         identityref
     |     +--rw voip-volte-capa*   identityref
     +--rw action-capabilities
     |  +--rw ingress-action-capa*   identityref
     |  +--rw egress-action-capa*    identityref
     |  +--rw log-action-capa*       identityref
     +--rw resolution-strategy-capabilities*   identityref
     +--rw default-action-capabilities*        identityref
     +--rw ipsec-method*   identityref
```

# Data Model Convergence (3/3)

- **Registration Interface Data Model for I2NSF IKE/IPsec**



```
<i2nsf-nsf-registrations
  xmlns="urn:ietf:params:xml:ns:yang:ietf-i2nsf-reg-interface"
  xmlns:capa="urn:ietf:params:xml:ns:yang:ietf-i2nsf-capability">
   <i2nsf-nsf-capability-registration>
    <nsf-name>general_firewall_capability</nsf-name>
    <nsf-capability-info>
     <i2nsf-capability>
       <condition-capabilities>
          <generic-nsf-capabilities>
           <ipv4-capa>capa:ipv4-protocol</ipv4-capa>
           <ipv4-capa>capa:exact-ipv4-address</ipv4-capa>
           <ipv4-capa>capa:range-ipv4-address</ipv4-capa>
           <tcp-capa>capa:exact-tcp-port-num</tcp-capa>
           <tcp-capa>capa:range-tcp-port-num</tcp-capa>
          </generic-nsf-capabilities>
       </condition-capabilities>
       <action-capabilities>
         <ingress-action-capa>capa:pass</ingress-action-capa>
         <ingress-action-capa>capa:drop</ingress-action-capa>
         <ingress-action-capa>capa:alert</ingress-action-capa>
         <egress-action-capa>capa:pass</egress-action-capa>
         <egress-action-capa>capa:drop</egress-action-capa>
         <egress-action-capa>capa:alert</egress-action-capa>
       </action-capabilities>
       <ipsec-method>ike-less</ipsec-method>
     </i2nsf-capability>
     ...
</i2nsf-nsf-registrations>
```

# Next Steps

- WG Last Call for I2NSF Interface Data Models
  - NSF Capability DM
  - NSF-Facing Interface DM
  - Consumer-Facing Interface DM
  - Registration Interface DM

- NSF Monitoring Data Model Draft
  - We will improve it through the implementation of NSF Monitoring DM.
  - We are planning to test it in IETF-105 Hackathon Project.

- Verification of Data Models by YANG Doctors
  - During WG Last Call, I2NSF WG chairs need to ask YANG doctors to review the data models.