Security Policy Translation in I2NSF

draft-yang-i2nsf-security-policy-translation-02

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Motivation for Policy Translator

- Current Situation in I2NSF
  - Different Security Policy Level Specifications exist between I2NSF User and NSFs:
    - I2NSF User: High-Level Security Policy
    - NSFs: Low-Level Security Policy

- Solution for this Situation
  - **Translation** is needed for Intent-Based Security by I2NSF User for easy security management.

- A Similar Standard (RFC 8075) from CORE WG
  - Guidelines for Mapping Implementations: HTTP to the Constrained Application Protocol (CoAP)
    - https://tools.ietf.org/html/rfc8075

A Previous Translation

- XSLT-based Policy Translation
  (XSLT: Extensible Stylesheet Language Transformations)
  - Popular method of XML-based policy translation.
  - Proposed by W3C in 1999.

- Limitations of XSLT
  1. Difficulty of Security Policy Construction
     - The manager must select the proper NSF directly.
  2. Inefficient Maintenance of Data Model
     - Cannot adopt automatically the changes of a data model.

A Proposed Translation

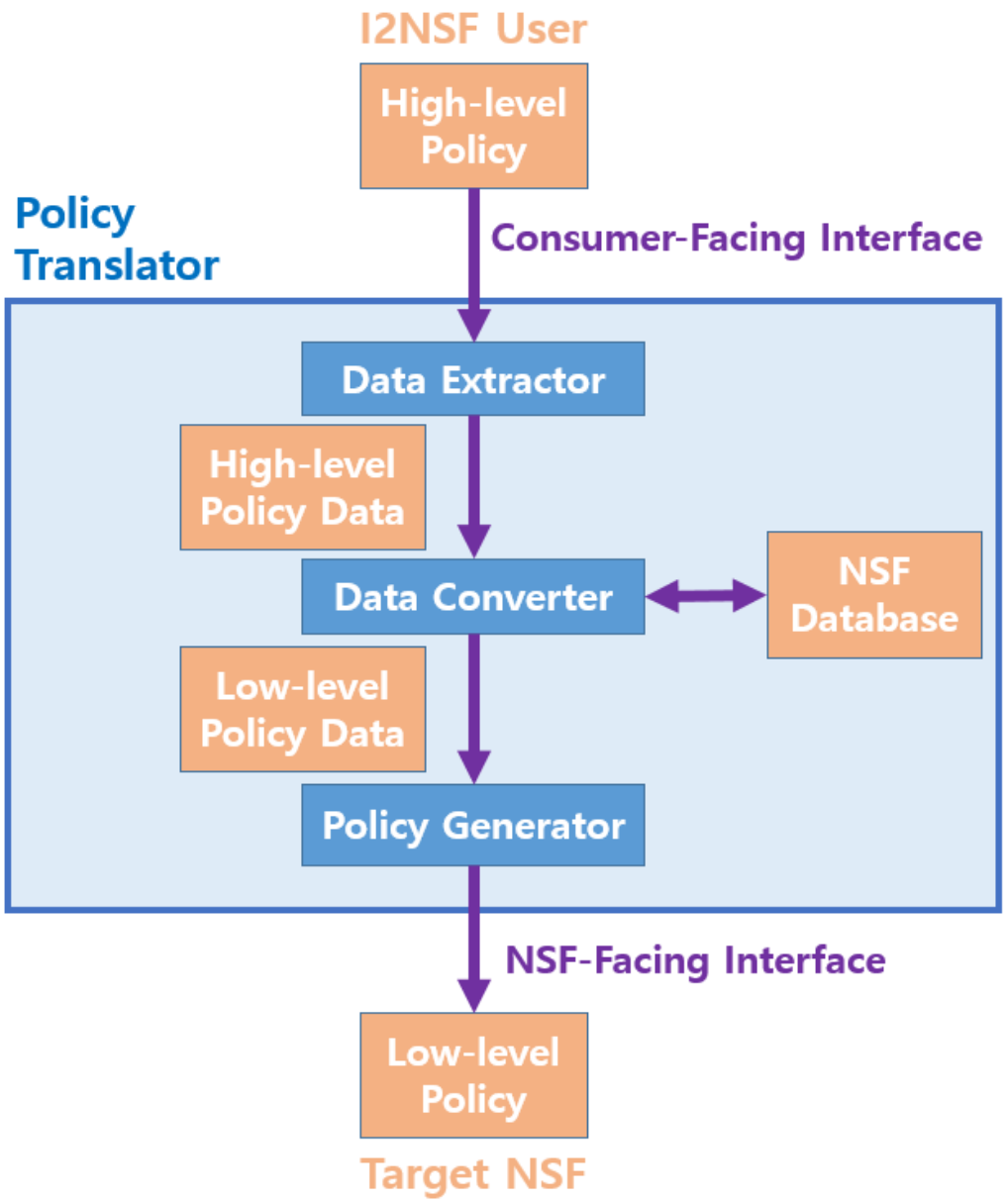
- Automata-based Policy Translation
  - A new method for XML-based policy translation.
  - **Mapping Rules** from a High-level YANG Data Model to a Low-level YANG Data Model

- Approach
  1. Ease of Security Policy Construction
     - The security manager does not need to select a proper NSF by himself.
  2. Efficient Maintenance
     - Can adopt automatically the changes of a data model.

Updates from the Previous Version

- The Previous Drafts:
  - draft-yang-i2nsf-security-policy-translastion-01
- Changes from the previous versions
  - Add scenarios and figures for better representation of the idea.
  - The translation process is clarified with examples.
  - Other changes are described in detail in the last Appendix part.

Translation Process by Mapping



High-level policy

```
<I2NSF>
    <name>block_web</name>
    <cond>
        <src>Son's_PC</src>
        <dest>malicious</dest>
    </cond>
    <action>block<action>
</I2NSF>
```

Translation

Low-level policy

```
<I2NSF>
    <rule-name>block_web</rule-name>
    <rules>
        <condition>
            <packet>
                <ipv4>10.0.0.1</ipv4>
                <ipv4>10.0.0.3</ipv4>
            </packet>
            <payload>
                <url>harm.com</url>
                <url>illegal.com</url>
            </payload>
        </condition>
        <action>drop</action>
    </rules>
</I2NSF>
```

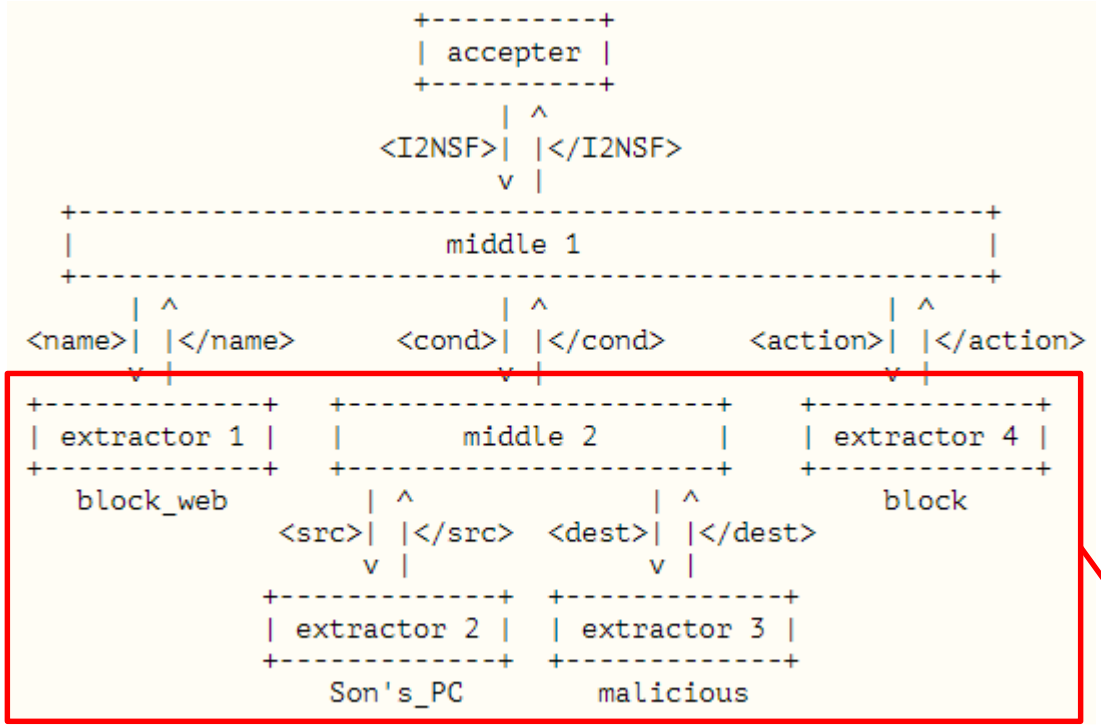
Next Steps

- We welcome comments from WG and will modify this draft according to the comments.

- **WG Adoption Call**
  - Security Policy Translation is a core part in Security Controller.
  - This draft aims at an Informational RFC.

Appendix 1:
Process of Security Policy Translation

Step 1: Extractor (DFA)



High-level policy

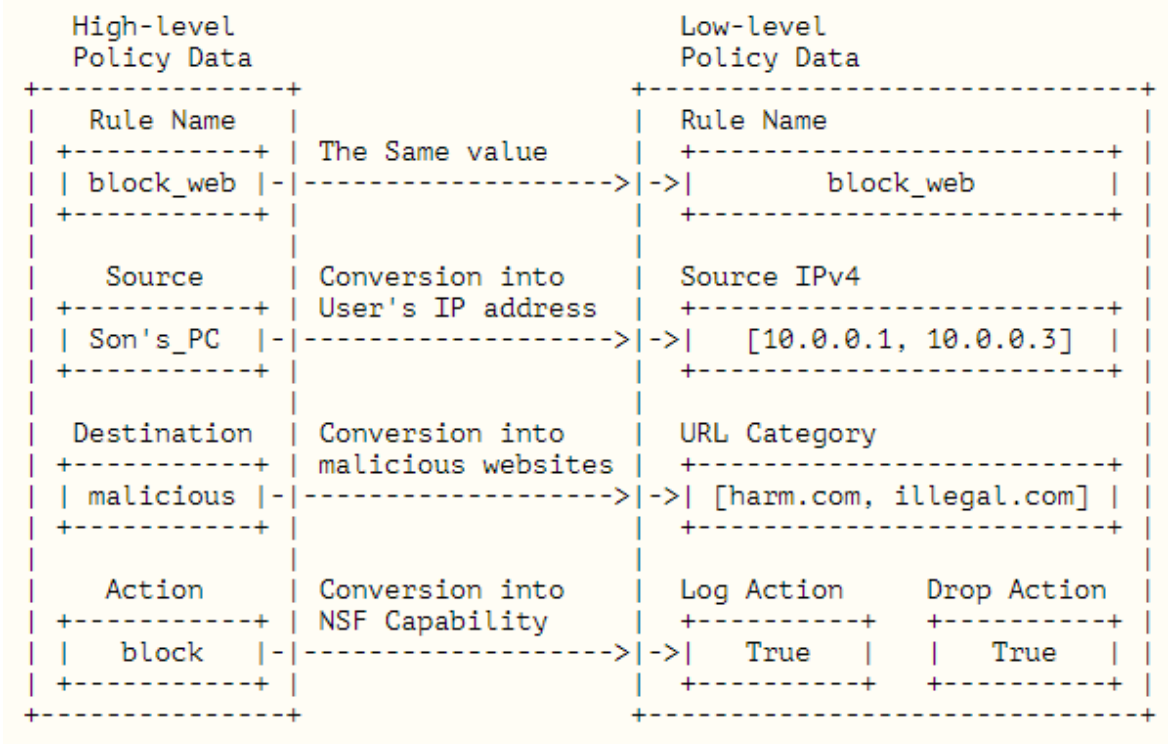
```
<I2NSF>
    <name>block_web</name>
    <cond>
        <src>Son's_PC</src>
        <dest>malicious</dest>
    </cond>
    <action>block<action>
</I2NSF>
```

Extraction

High-level policy data

Rule Name	block_web
Source	Son's_PC
Destination	malicious
Action	block

Step 2: Data Converter (1/2)



High-level policy data

Rule Name	block_web
Source	Son's_PC
Destination	malicious
Action	block

Data Conversion

Low-level policy data

Rule Name	block_web
Source IPv4	[10.0.0.1, 10.0.0.3]
URL Category	[harm.com, illegal.com]
Log Action	True
Drop Action	True

Step 2: Data Converter (2/2)

Low-level policy data

Rule Name	block_web
Source IPv4	[10.0.0.1, 10.0.0.3]
URL Category	[harm.com, illegal.com]
Log Action	True
Drop Action	True

Policy Provisioning

Policy Provisioning

Log-keeper

Rule Name	block_web
Source IPv4	[10.0.0.1, 10.0.0.3]
Log Action	True

Web-filter

Rule Name	block_web
Source IPv4	[10.0.0.1, 10.0.0.3]
URL Category	[harm.com, illegal.com]
Drop Action	True

Step 3: Generator (CFG)

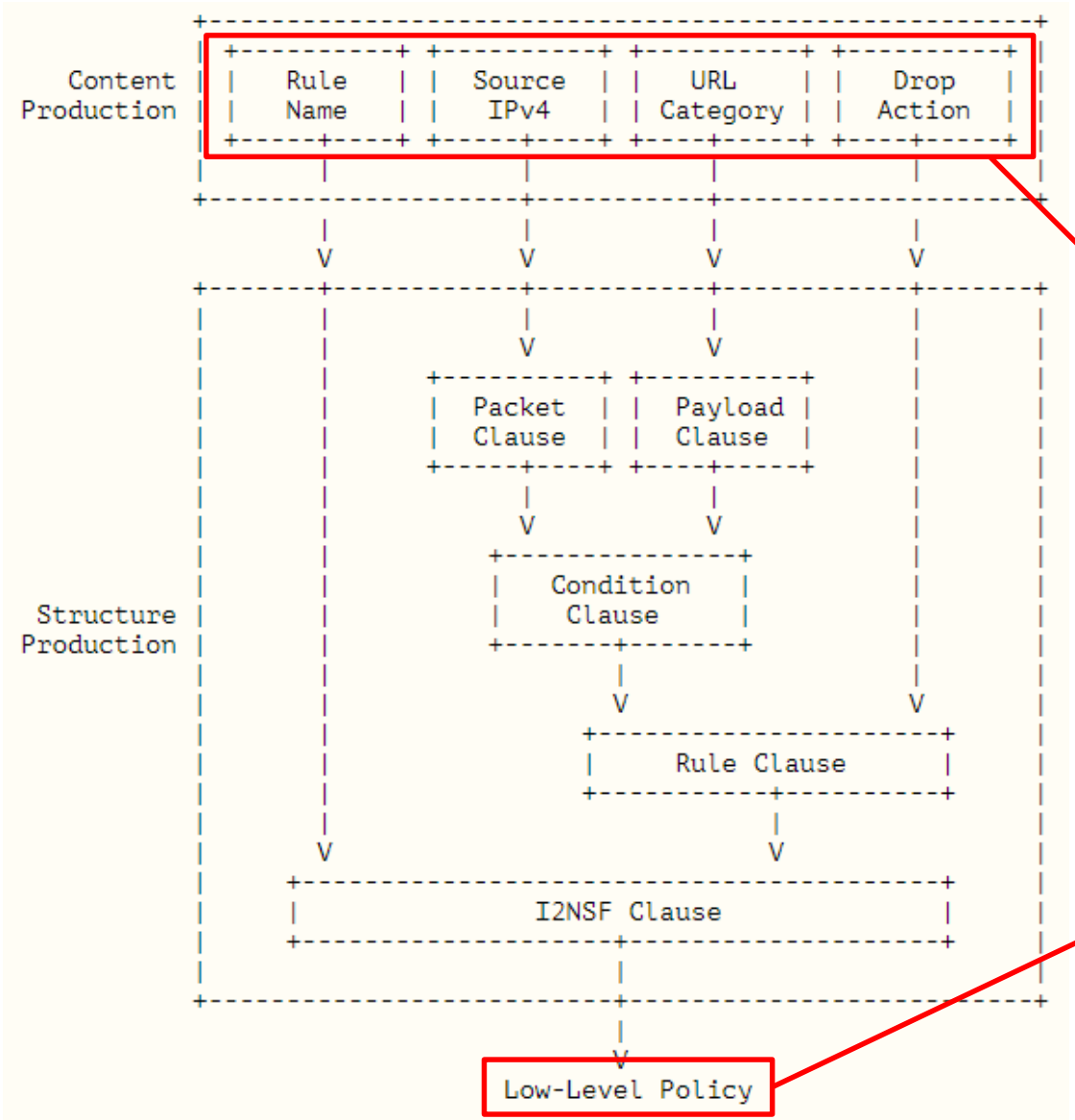


Figure 7: Generator Construction for Web-Filter NSF

Low-level policy data

Rule Name	block_web
Source IPv4	[10.0.0.1, 10.0.0.3]
URL Category	[harm.com, illegal.com]
Drop Action	True

Generation

Low-level policy

```
<I2NSF>
    <rule-name>block_web</rule-name>
    <rules>
        <condition>
            <packet>
                <ipv4>10.0.0.1</ipv4>
                <ipv4>10.0.0.3</ipv4>
            </packet>
            <payload>
                <url>harm.com</url>
                <url>illegal.com</url>
            </payload>
        </condition>
        <action>drop</action>
    </rules>
</I2NSF>
```

Appendix 2:
Changes from the Previous Draft

Changes from the Previous Version (1/12)

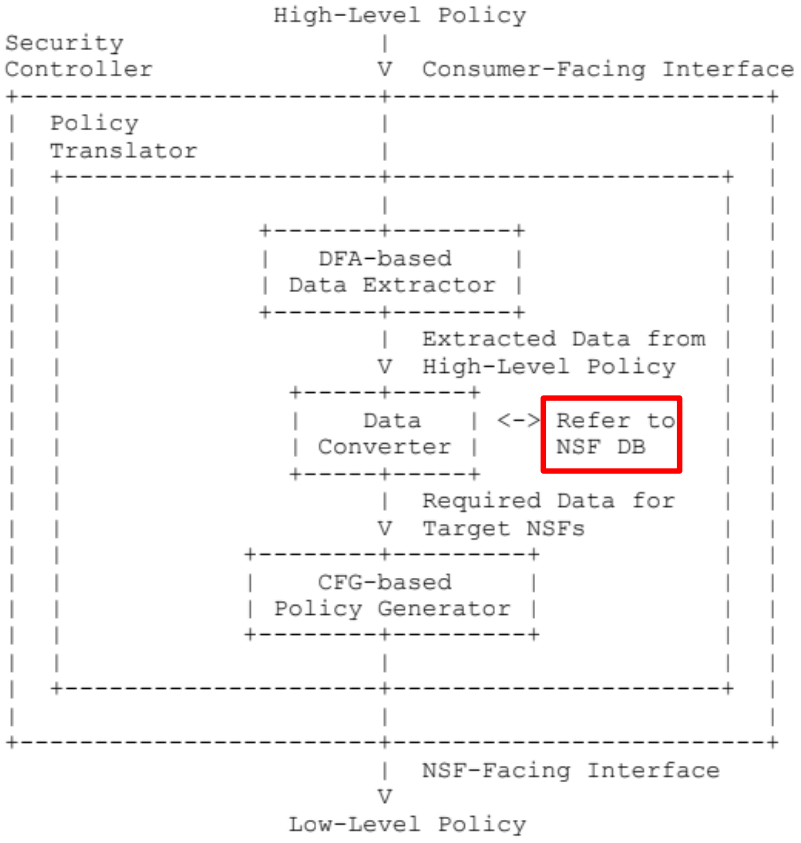
- 3. Necessity for Policy Translator
  - Examples are added for emphasizing the necessity of translation.
  - Both policies are equilibrium. The first policy is for I2NSF User, and the second policy is for NSF.
  - I2NSF has a role that connects Users and NSF.
    - I2NSF requires a translator that automatically converts the first policy to the second policy even if the user gives the first one.

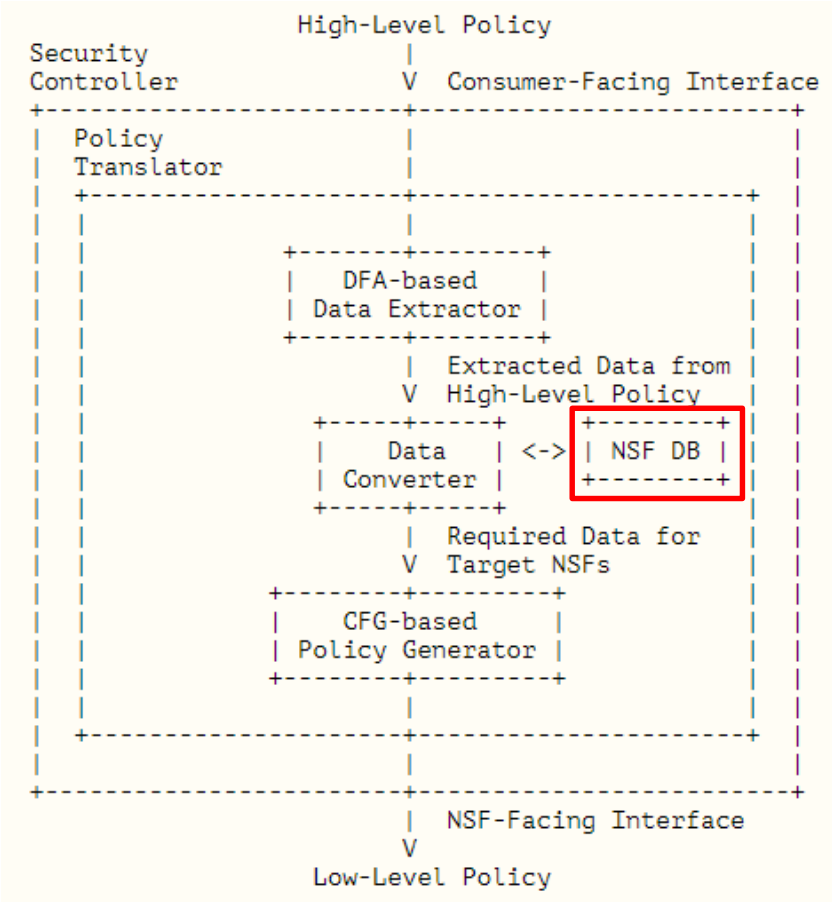
```
o  Block my son's computers from malicious websites.

o  Drop packets from the IP address 10.0.0.1 and 10.0.0.3 to harm.com
   and illegal.com
```

Changes from the Previous Version (2/12)

- 4.1. Overall Structure of Policy Translator
  - NSF DB is changed to a component in the figure of an overall design of policy translator.





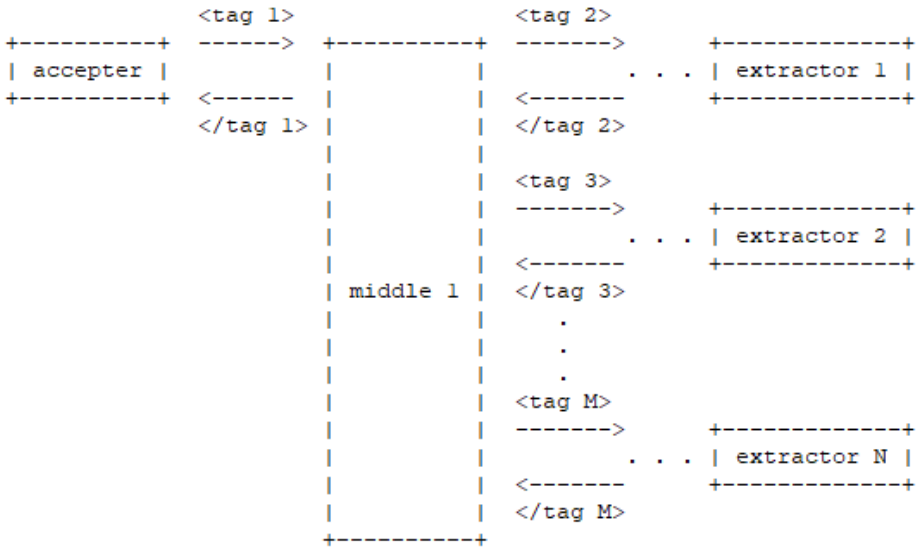
Changes from the Previous Versions (3/12)

- 4.2. DFA-based Data Extractor
  - The description is clarified for better understanding.
  - This Section is divided as two subsections: ‘Design’ and ‘Example Scenario’.
  - The figure of DFA Architecture is changed to show the hierarchy structure.
  - An example scenario and the process of the Data Extractor are added.

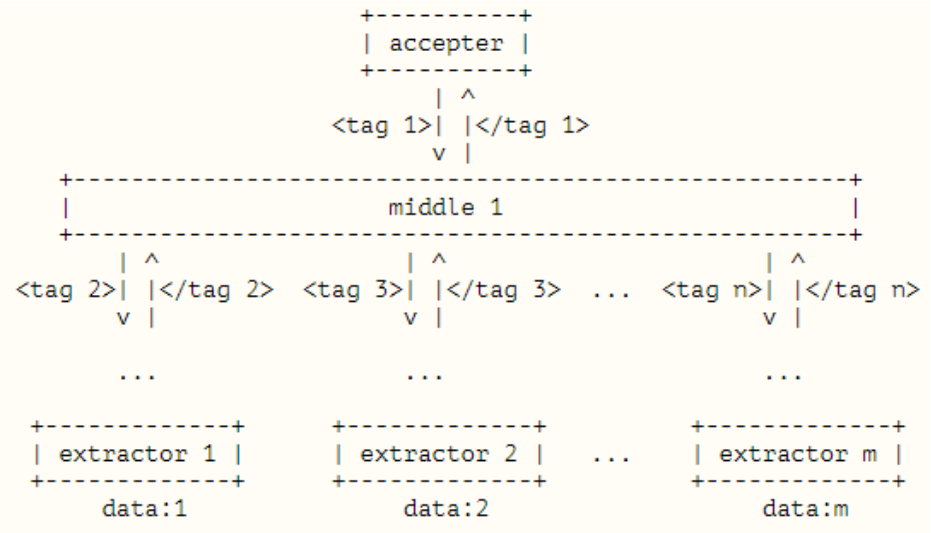
Changes from the Previous Version (4/12)

- 4.2. DFA-based Data Extractor
  - The figure of DFA Architecture is changed to show the hierarchy structure.

Previous Figure



Changed Figure



Changes from the Previous Version (5/12)

- 4.2. DFA-based Data Extractor
  - An example scenario and the process of the Data Extractor are added.

```
<I2NSF>
    <name>block_web</name>
    <cond>
        <src>Son's_PC</src>
        <dest>malicious</dest>
    </cond>
    <action>block<action>
</I2NSF>
```

Figure 3: The Example of High-level Policy

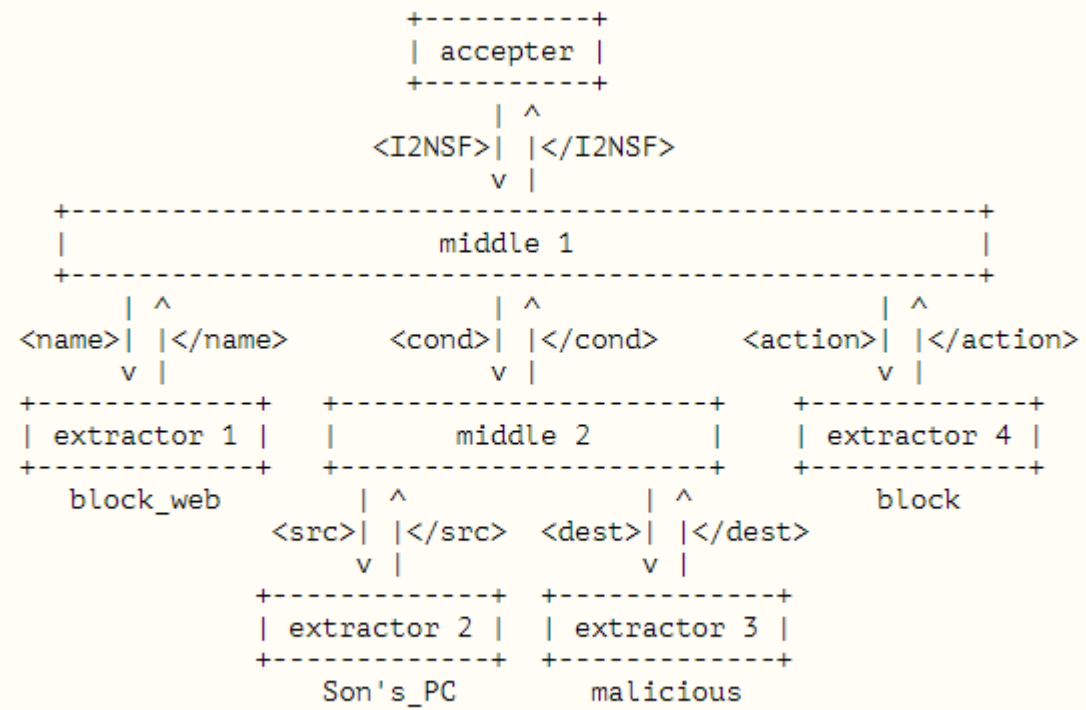


Figure 4: The Example of Data Extractor

Changes from the Previous Version (6/12)

- 4.3. Data Converter
  - The description is clarified for better understanding.
  - This Section is divided as three subsections: ‘Role’, ‘Conversion’, and ‘Policy Provisioning’.
  - The role of Data Converter is emphasized.
  - The figures of data conversion and policy provisioning are added.

Changes from the Previous Version (7/12)

- 4.3. Data Converter
  - The figure and explanation of data conversion are added.

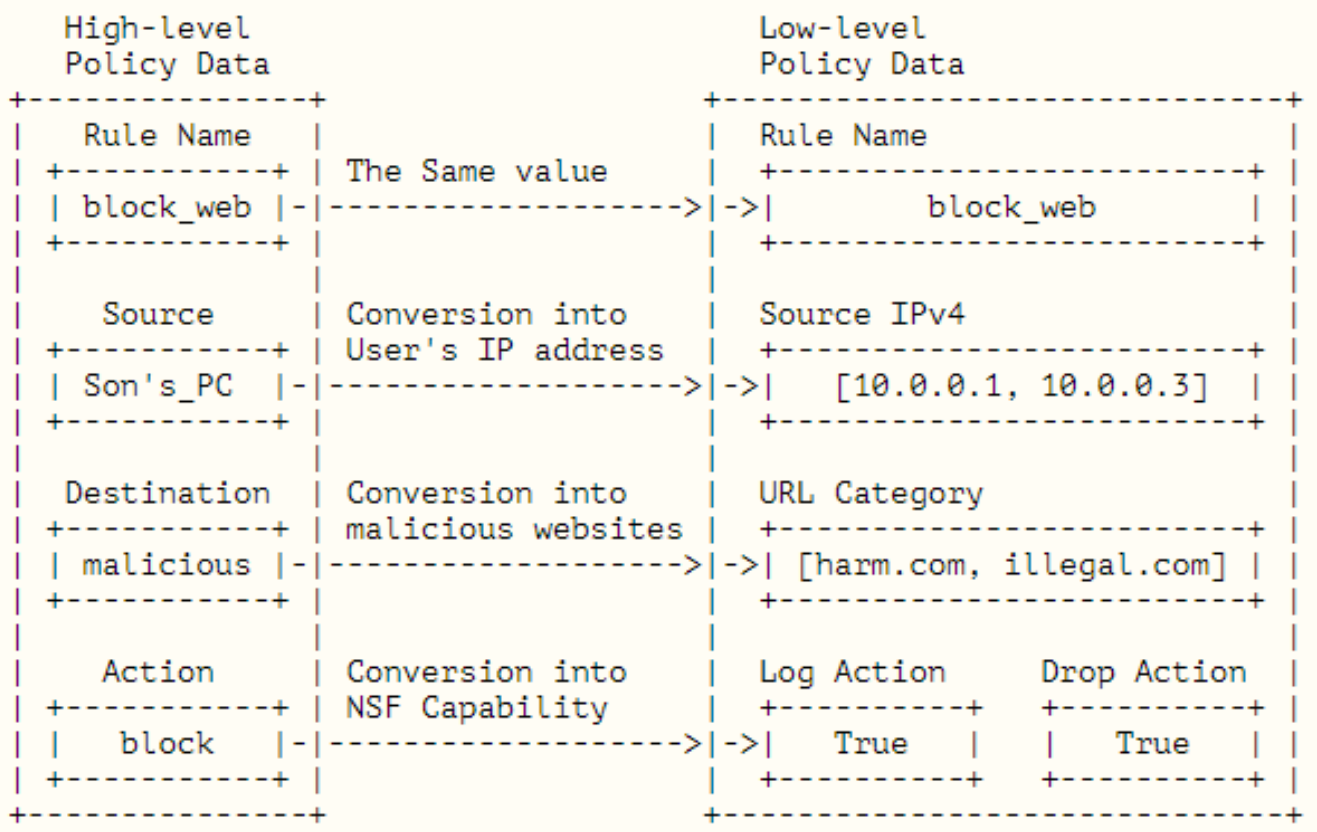


Figure 5: Example of Data Conversion

Changes from the Previous Version (8/12)

- 4.3. Data Converter
  - The figure of policy provisioning is added.

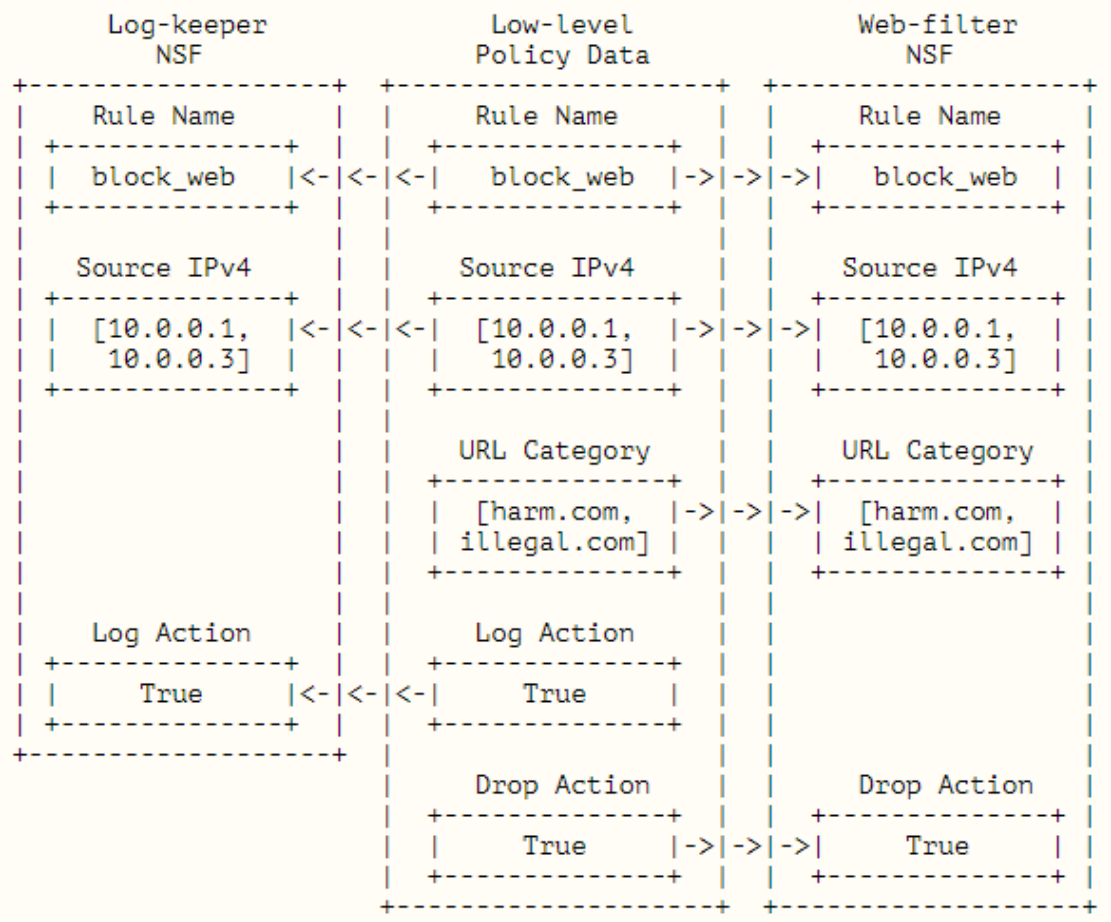


Figure 6: Example of Policy Provisioning

Changes from the Previous Version (9/12)

- 4.4. CFG-based Policy Generator
  - The description is clarified for better understanding.
  - The Section is divided as three subsections: ‘Structure Production’, ‘Content production’, and ‘Generator Construction’.
  - Examples of each production are added to help readers understand.
  - The figures for example scenario and process of the Policy Generator are added.

Changes from the Previous Version (10/12)

- 4.4. CFG-based Policy Generator
  - The examples of each production are added to help readers understand.

Example of Content Production

```
o  [cont_ipv4] -> [cont_ipv4][cont_ipv4] (Allow duplication.)
o  [cont_ipv4] -> <ipv4>[cont_ipv4_data]</ipv4>
o  [cont_ipv4_data] -> 10.0.0.1 | 10.0.0.3
```

Example of Structure Production

```
o  [struct_i2nsf] -> <I2NSF>[cont_name][struct_rules]</I2NSF>
```

Changes from the Previous Version (11/12)

- 4.4. CFG-based Policy Generator
  - The figures of example scenario and the process of the Policy Generator are added.

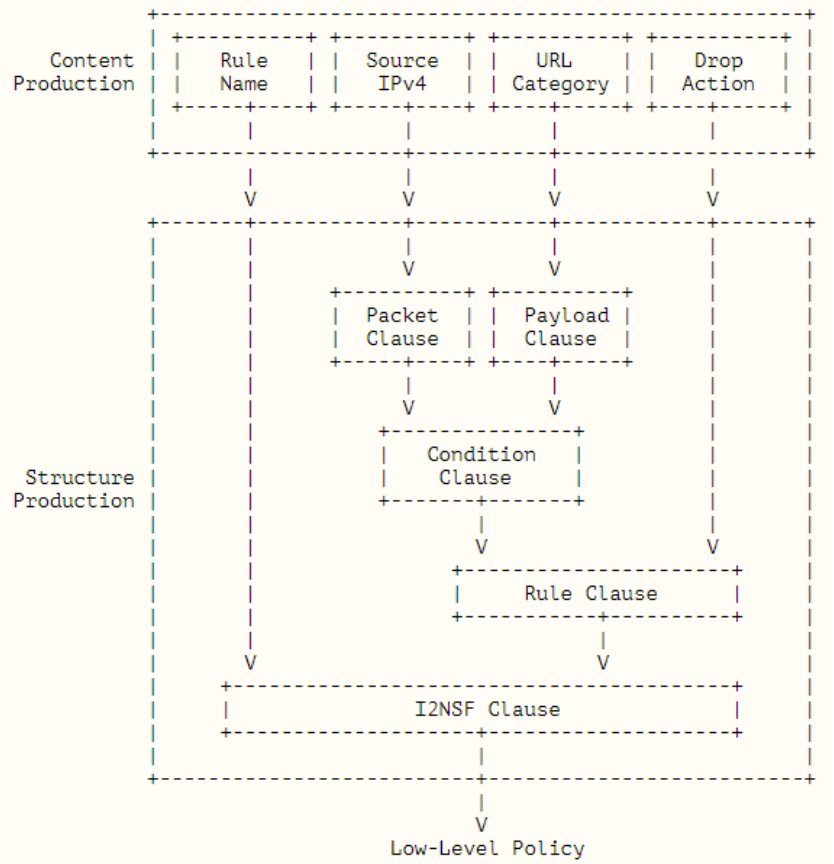


Figure 7: Generator Construction for Web-Filter NSF

```
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    <rule-name>block_web</rule-name>
    <rules>
        <condition>
            <packet>
                <ipv4>10.0.0.1</ipv4>
                <ipv4>10.0.0.3</ipv4>
            </packet>
            <payload>
                <url>harm.com</url>
                <url>illegal.com</url>
            </payload>
        </condition>
        <action>drop</action>
    </rules>
</I2NSF>
```

Figure 8: Example of Low-Level Policy

Changes from the Previous Version (12/12)

- 6. Security Considerations
  - This Section is added. There is no security concern in policy translation.

- 8. References
  - This Section is divided by two subsections: ‘Normative References’ and ‘Informative References’.
  - References for Automata, XML(Extensible Markup Language), and XSLT(Extensible Stylesheet Language Transformations) are added.