YANG Data Model for Access Control List Configuration draft-huang-netmod-acl-02

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Purpose

- ACL: Access Control Lists
  - Used to filter traffic (“Firewall Rules”); major part of device configurations
  - No configuration complete without ACLs
- Why a YANG data model?
  - Netconf and YANG are intended for network device configuration
  - Make ACL more accessible to automated applications, examples:
    - I2RS, Dynamic Intrusion Protection Systems
    - Dynamic setup/configuration of services, e.g. temporary firewall rule adjustments for video conferences
- Proposed model covers popular ACLs, incorporates rich set of filters
  - IP ACL, MAC ACL, ARP ACL as initial ACL types
  - More than 50 filter criteria
- ACL Configuration will benefit from standardization
  - Needed both by administrators and by applications
  - Propose as standards-track Internet Draft

Actions taken from last IETF

- "How extensible" – could it support ACL chains, does it support multiple vendors

  ACL chains: New draft outlines which extensions would be needed; extensions are straightforward, can be incorporated into module itself if desired

  Engaged with Juniper colleagues; so far no objections/flags received

- "Are there models (non-IETF) that we can borrow, e.g. DMTF's CIM"

  ACLs are not part of their standard but there are vendor extensions that cover

  Structure of those corresponds to similar design pattern; any mapping/mediation would appear straightforward

- "Engage IETF Security Experts"

  Message sent to IETF Security Directorate through Benoit (Ops Area Director)

  Engaged Joseph Salowey, comments:

  RFC 3588 – Diameter Protocol – defines AAA protocol IP filters against interfaces (not ACL)

  There are 3 parameters that are not part of current ACL data model

  1 could be added/extended if equivalent functionality desired (concerning direction)

  2 TCP filters, can be accommodated through TCP flag value and flag mask leaves

  Consider adding info who created an ACL rule – can be accommodated through special-purpose object

Draft-huang-netmod-acl-02.txt

- http://www.ietf.org/id/draft-huang-netmod-acl-02.txt
- Changes from -01

  Explained how to extend the current ACL to support ACL chain. Gave an example for ipv4. Same pattern can apply to ipv6, mac, and arp aces if needed.

  Documented findings re: other models

- Modular and extensible ACL Management Framework
- 5 YANG modules

  ACL – items common to ACLs regardless of type – "abstract superclass"

  IP ACL, MAC ACL, ARP ACL as initial ACL types – can be extended

  Common datatypes

    Required by but not specific to ACL

    Could be reused by other modules

- Emphasis on configuration

  Very limited statistics

Proposal Summary

- Make YANG Data Model for ACL a standards-track working group item
  - ACLs are an important part of device configurations
  - Proprietary today
  - Enabler for many applications, generally related to security
  - Will clearly benefit from standardization
- Rev 02 of draft has already been posted
  - Extensible + modular framework
  - Includes support for 3 different types of ACL, more can be added
  - Covers comprehensive set of parameters;
    feature statements allow for customization and device adaptation
  - Possible items for discussion
    - Inclusion of chaining feature
    - Support for statistics

ACL concept

- ACL: Access Control List
  - An ordered set of rules used to filter traffic on a networking device
- Access Control Entry (ACE): a representation of a rule
  - Left hand side: the matching criteria, or "filter"
  - Right hand side : the action to take – permit/deny a packet
  - Note: can generalize ACL with further actions: packet capture, audit logging, ...
- First rule that matches is applied
  - Most specific rules first to avoid rule shadowing
- ACLs are applied against interfaces
  - Interface refers to ACL (ACL specified independent of interface)
  - Different interfaces can use different ACLs, or use the same

ACL Types covered in the data model

- IP ACLs
  - Filter traffic based on IP information in the Layer 3 header of packets.
- MAC ACLs
  - Filter traffic using the information in the Layer 2 header of each packet.
- ARP ACLs
  - Filter IP- and non-IP-based traffic by checking the Ethernet type code field in the Layer 2 header.

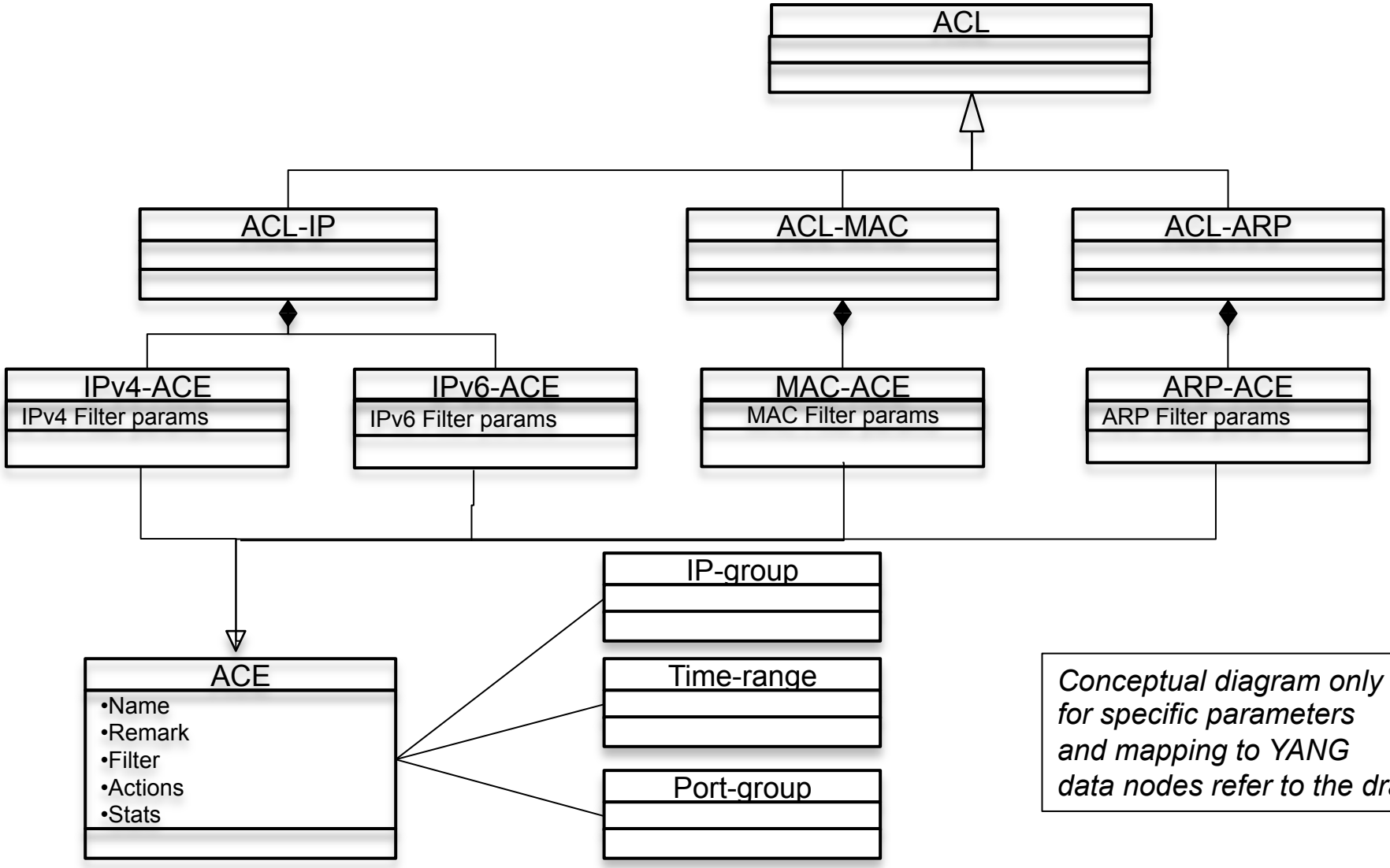
Each ACL includes only ACEs of its type (no mix and match)

Framework can be extended with additional ACL types

Augment ACL YANG module

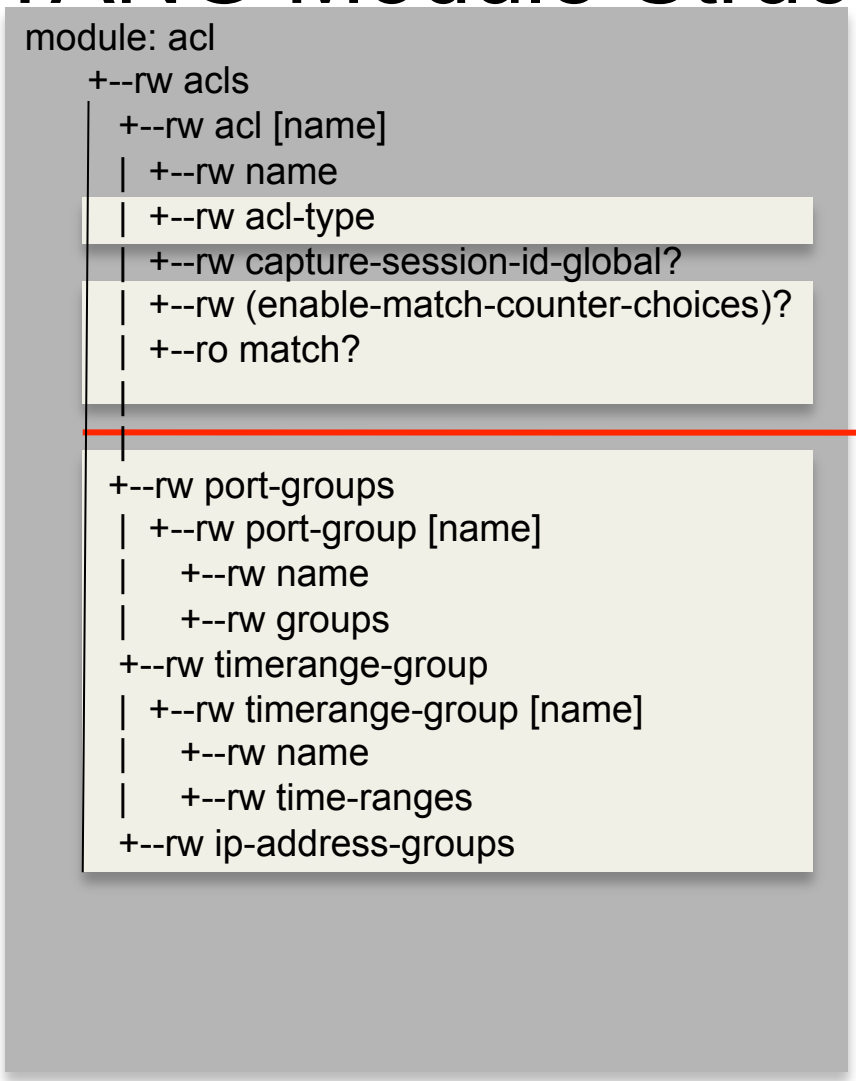
Follow design pattern of other ACL types, leverage common ACL data types

ACL module overview



Conceptual diagram only – for specific parameters and mapping to YANG data nodes refer to the draft

YANG Module Structure



Generic ACL aspects,
common to each ACL type

Determines which types of ACEs
can be inserted

Not configuration related,
could be separated

Insertion point for specific ACL types
(augmentation hook)

Auxiliary convenience objects
to simplify reuse of port groupings
and schedule information
(could move outside acls container)

YANG module structure (contd.)

```
module: acl
     +--rw acls
       +--rw acl [name]
       |  +--rw acl-ip:afi
       |  +--rw acl-ip:ipv6-aces
       |  |  +--rw acl-ip:ipv6-ace [name]
       |  |     +--rw acl-ip:name
       |  |     +--rw (remark-or-ipv6-case)?
       |  |        +--:(remark)
       |  |        |   +--rw acl-ip:acl-remark
       |  |        +--:(ipv6-ace)
       |  |        |   +--rw acl-ip:filters
       |  |        |      +-- filter parameters
       |  |        |   +--rw acl-ip:actions
       |  |        |      +-- action parameters
       |  |        +-- ro acl-ip:match
```

Indicates IP address type

ACLs can include “comment lines” for human/admin consumption
Included in YANG module to maintain consistency with CLI

“left hand side”

“right hand side”

Not configuration related, could be separated

Generic design pattern that is reflected in every ACL type
All ACL type specifics are in the filter parameters and in the actions

YANG module structure (contd.)

```
module: acl
     +--rw acls
       +--rw acl [name]
       |  +--rw acl-ip:afi
       |  +--rw acl-ip:ipv4-aces
       |  |  +--rw acl-ip:ipv4-ace [name]
       |  |     +--rw acl-ip:name
       |  |     +--rw (remark-or-ipv4-case)?
       |  |        +--:(remark)
       |  |        |   +--rw acl-ip:acl-remark
       |  |        +--:(ipv4-ace)
       |  |        |   +--rw acl-ip:filters
       |  |        |      +-- filter parameters
       |  |        |   +--rw acl-ip:actions
       |  |        |      +-- action parameters
       |  |        +-- ro acl-ip:match
```

IPv4
(IPv4 and IPv6 specified in same submodule)

Indicates IP address type

ACLs can include “comment lines” for human/admin consumption
Included in YANG module to maintain consistency with CLI

“left hand side”

“right hand side”

Not configuration related, could be separated

Generic design pattern that is reflected in every ACL type
All ACL type specifics are in the filter parameters and in the actions

YANG module structure (contd.)

```
module: acl
      +--rw acls
        +--rw acl [name]
        |  +--rw acl-mac:mac-aces
        |  |  +--rw acl-mac:mac-ace [name]
        |  |     +--rw acl-mac:name
        |  |     +--rw (remark-or-mac-case)?
        |  |        +--:(remark)
        |  |        |   +--rw acl-mac:remark
        |  |        +--:(mac-ace)
        |  |        |   +--rw acl-mac:filters
        |  |        |       +-- filter parameters
        |  |        |   +--rw acl-mac:actions
        |  |        |       +-- action parameters
        |  |        +-- ro acl-mac:match
```

MAC
(separate module)

Generic design pattern that is reflected in every ACL type
All ACL type specifics are in the filter parameters and in the actions

YANG module structure (contd.)

```
module: acl
      +--rw acls
        +--rw acl [name]
        |  +--rw acl-arp:arp-aces
        |  |  +--rw acl-arp:arp-ace [name]
        |  |     +--rw acl-arp:name
        |  |     +--rw (remark-or-arp-case)?
        |  |        +--:(remark)
        |  |        |   +--rw acl-arp:remark
        |  |        +--:(arp-ace)
        |  |        |   +--rw acl-arp:filters
        |  |        |       +-- filter parameters
        |  |        |   +--rw acl-arp:actions
        |  |        |       +-- action parameters
        |  |        +-- ro acl-arp:match
```

ARP
(separate module)

Generic design pattern that is reflected in every ACL type
All ACL type specifics are in the filter parameters and in the actions

YANG module structure (contd.)

```
module: acl
    +--rw acls
      +--rw acl [name]
      |  +--rw acl-ip:ipv6-aces
      |  |  +--rw acl-ip:ipv6-ace [name]
      |  |     +--rw acl-ip:name
      |  |     +--rw (remark-or-ipv6-case)?
      |  |        +--:(ipv6-ace)
      |  |           |  +--rw acl-ip:filters
      |  |           |     +-- rw (source-address-host-group)?
      |  |           |     +-- rw (dest-address-host-goup)?
      |  |           |     +-- rw acl-ip:protocol?
      |  |           |     +-- rw acl-ip:capture-session-id?
      |  |           |     +-- rw acl-ip:fragments?
      |  |           |     +-- rw acl-ip:time-range?
      |  |           |     +-- rw acl-ip:src-ports?
      |  |           |     +-- rw acl-ip:dest-ports?
      |  |           |     +-- ...
      |  |           |  +--rw acl-ip: actions
      |  |           |     +-- rw acl-ip:action
      |  |           |     +-- rw acl-ip:log?
```

IPv6-specific parameters, but could add IP-v6 Specific filters

Insertion point for specific filters (augmentation hook)

Common actions but could add IP-specific actions later, such as copy, chain

Insertion point for additional actions, e.g. ACL chaining

ACL Chain ipv4 Example

```
augment "/acl:acls/acl:acl/acl-ip:ipv4-aces" +
    "/acl-ip:ipv4-ace/acl-ip:actions" {
    leaf chain {
        type acl-ref ;
        description "Reference to another ACL name to chain the ACEs";
    }
}
```

Q & A

Thank You

Types specific to ACL (ACL module)

YANG type	base type
acl-comparator	enumeration
acl-action	enumeration
acl-remark	string
acl-type-ref	identityref
acl-ref	leafref
port-group-ref	leafref
ip-address-group-ref	leafref
time-range-ref	leafref
weekdays	bits
acl-name-string	string

Common types – common module (required but not specific to ACL)

YANG type	base type
cos	uint8
tos	uint8
precedence	uint8
tcp-flag-type	enumeration
ether-type	string
ip-protocol	uint8
igmp-code	uint8
icmp-type	uint32
icmp-code	uint32
vlan-identifier	uint16
time-to-live	uint8

Example

- **ACL Example:**

  Denies TELNET traffic from 14.3.6.234 bound for host 6.5.4.1 from leaving.
  Denies all TFTP traffic bound for TFTP servers.
  Permits all other IP traffic.

- **ACL CLI:**

  access-list ip iacl

  deny tcp 14.3.6.234 0.0.0.0 host 6.5.4.1 eq 23

  deny udp any any eq tftp

  permit ip any any

XML instantiation

```
<acls>
        <acl >
            <name>iacl</name>
            <acl-type>ip-acl</acl-type>
            <enable-match-counter>false</enable-match-counter>
            <acl-ip:afi>ipv4</acl-ip:afi>
            <acl-ip:ipv4-aces>
                <acl-ip:ipv4-ace>
                    <acl-ip:name>deny10</acl-ip:name>
                    <acl-ip:filters>
                        <acl-ip:acl-ip:protocol>6</acl-ip:acl-ip:protocol>
                        <acl-ip:ip-source-address> 14.3.6.234 </acl-ip:ip-source-address>
                        <acl-ip:ip-source-mask>0.0.0.0</acl-ip:ip-source-mask>
                        <acl-ip:ip-dest-host-address> 6.5.4.1 </acl-ip:ip-dest-host-address>
                        <acl-ip:des-comparator>eq</acl-ip:des-comparator>
                        <acl-ip:des-port>23</acl-ip:des-port>
                    </acl-ip:filters>
                    <acl-ip:actions>
                            <acl-ip:action>deny</acl-ip:action>
                        </acl-ip:actions>
                </acl-ip:ipv4-ace>
        ....
```

XML instantiation (contd.)

```
            ....
            <acl-ip:ipv4-ace>
                <acl-ip:name>permit-20</acl-ip:name>
                <acl-ip:filters>
                    <acl-ip:protocol>17</acl-ip:protocol>
                    <acl-ip:ip-source-any/>
                    <acl-ip:ip-dest-any/>
                    <acl-ip:des-comparator>eq</acl-ip:des-comparator>
                    <acl-ip:des-port>69</acl-ip:des-port>
                </acl-ip:filters>
                <acl-ip:actions>
                    <acl-ip:action>deny</acl-ip:action>
                </acl-ip:actions>
            </acl-ip:ipv4-ace>

            <acl-ip:ipv4-ace>
                <acl-ip:name>any-30</acl-ip:name>
                <acl-ip:filters>
                    <acl-ip:ip-source-any/>
                    <acl-ip:ip-dest-any>
                </acl-ip:filters>
                <acl-ip:actions>
                    <acl-ip:action>permit</acl-ip:action>
                </acl-ip:actions>
            </acl-ip:ipv4-ace>
        </acl-ip:ipv4-aces>
    </acl>
</acls>
```