
PROLOG ASSIGNMENT

By

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For the fulfilment of assignment under course Logic in Computer Science (CS F214).

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*General Information -

This Program implements firewall rules on an incoming packet.

It accepts an incoming packet as a query and checks the data values of each clause with respect to the rule set defined in the database.

The rule set follows a specific syntax and that should be followed for the program to execute correctly.

The packet will be either accepted, rejected or dropped based on the conditions specified in the database.

The packet will be accepted only is all the clauses are satisfied.

The packet will be rejected if any one clause is rejected.

The packet will be dropped if one or more clause is dropped and no clause is rejected.

The highest priority is given to Rejected after which Dropped is given priority. Accept has the least priority.

Database Description

#The database consists of multiple rules in the form of three predicates
- 'accept' , 'reject' and 'drop'

```
accept(adapter rule ,
        format : "A-B"
                 ["A","B","C"]
                 ["T"]
        ethernet rule - protocol_id ,
        format : ["arp" , "aarp" , "\alias_notation"]
                 [10,2,6]
                 "1-6"
                 [8]
        ethernet rule - vlan_no ,
        format : [11,12,23]
                 "2-5"
                 [5]
        ipv4 rule - ip_src_address,
        format : ["192.45.54.2","172.21.87.90"]
```

["192.45.54.2"]
"172.34.33.63-34.62.58.24"

ipv4 rule - ip_dst_address,
format : ["192.45.54.2","172.21.87.90"]
["192.45.54.2"]
"172.34.33.63-34.62.58.24"

ipv4 rule - tcp_udp_src_port,
format : [11,12,23]
"2-5"
[5]

ipv4 rule - tcp_udp_dst_port,
format : [11,12,23]
"2-5"
[5]

ipv4 rule - icmp_type,
format : [11,12,23]
"2-5"
[5]

ipv4 rule - icmp_message,
format : ["Echo Reply"]
["Redirect","Parameter Problem","Echo Reply"]).

acceptv6(adapterv6 rule ,
format : "A-B"
["A","B","C"]
["T"]
ethernetv6 rule - protocol_idv6 ,
format : ["arp" , "aarp" , "\alias_notation"]
[10,2,6]
"1-6"
[8]
ethernet rule - vlan_no_v6 ,
format : [11,12,23]
"2-5"
[5]

ipv6 rule - ipv6_src_address,
format : ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c2","2041:0000:130F:
0000:0000:07C0:853A:140B"]
["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c2"]
"2001:0db8:0a0b:12f0:0000:0000:0000:0000-2001:0db8:0a0b:
12f0:ffff:ffff:ffff:ffff"

ipv6 rule - ipv6_dst_address,
format : ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c3","2041:0000:130F:
0000:0000:07C0:853A:140C"]
["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c3"]
"2001:0db8:0a0b:12f0:0000:0000:0000:0001-2001:0db8:0a0b:
12f1:0000:0000:0000:0000"

ipv6 rule - tcp_udp_src_port_v6,
format : [11,12,23]
"2-5"
[5]

ipv6 rule - tcp_udp_dst_port_v6,
format : [11,12,23]
"2-5"
[5]

```
            ipv6 rule - icmpv6_type,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - icmpv6_message,
            format : ["Echo Reply"]
                        ["Redirect","Parameter Problem","Echo Reply"]).

reject( adapter rule ,
            format : "A-B"
                        ["A","B","C"]
                        ["T"]
            ethernet rule - protocol_id ,
            format : ["arp" , "aarp" , "\alias_notation"]
                        [10,2,6]
                        "1-6"
                        [8]
            ethernet rule - vlan_no ,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv4 rule - ip_src_address,
            format : ["192.45.54.2","172.21.87.90"]
                        ["192.45.54.2"]
                        "172.34.33.63-34.62.58.24"

            ipv4 rule - ip_dst_address,
            format : ["192.45.54.2","172.21.87.90"]
                        ["192.45.54.2"]
                        "172.34.33.63-34.62.58.24"

            ipv4 rule - tcp_udp_src_port,
            format : [11,12,23]
                        "2-5"
                        [5]
            ipv4 rule - tcp_udp_dst_port,
            format : [11,12,23]
                        "2-5"
                        [5]
            ipv4 rule - icmp_type,
            format : [11,12,23]
                        "2-5"
                        [5]
            ipv4 rule - icmp_message,
            format : ["Echo Reply"]
                        ["Redirect","Parameter Problem","Echo Reply"]).

rejectv6( adapterv6 rule ,
            format : "A-B"
                        ["A","B","C"]
                        ["T"]
            ethernetv6 rule - protocol_idv6 ,
            format : ["arp" , "aarp" , "\alias_notation"]
                        [10,2,6]
                        "1-6"
                        [8]
            ethernet rule - vlan_no_v6 ,
            format : [11,12,23]
                        "2-5"
                        [5]
```

```
            ipv6 rule - ipv6_src_address,
            format : ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c2","2041:0000:130F:
0000:0000:07C0:853A:140B"]
                        ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c2"]
                        "2001:0db8:0a0b:12f0:0000:0000:0000:0000-2001:0db8:0a0b:
12f0:ffff:ffff:ffff:ffff"

            ipv6 rule - ipv6_dst_address,
            format : ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c3","2041:0000:130F:
0000:0000:07C0:853A:140C"]
                        ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c3"]
                        "2001:0db8:0a0b:12f0:0000:0000:0000:0001-2001:0db8:0a0b:
12f1:0000:0000:0000:0000"

            ipv6 rule - tcp_udp_src_port_v6,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - tcp_udp_dst_port_v6,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - icmpv6_type,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - icmpv6_message,
            format : ["Echo Reply"]
                        ["Redirect","Parameter Problem","Echo Reply"]).


drop( adapter rule ,
            format : "A-B"
                        ["A","B","C"]
                        ["T"]
            ethernet rule - protocol_id ,
            format : ["arp" , "aarp" , "\alias_notation"]
                        [10,2,6]
                        "1-6"
                        [8]
            ethernet rule - vlan_no ,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv4 rule - ip_src_address,
            format : ["192.45.54.2","172.21.87.90"]
                        ["192.45.54.2"]
                        "172.34.33.63-34.62.58.24"

            ipv4 rule - ip_dst_address,
            format : ["192.45.54.2","172.21.87.90"]
                        ["192.45.54.2"]
                        "172.34.33.63-34.62.58.24"

            ipv4 rule - tcp_udp_src_port,
            format : [11,12,23]
                        "2-5"
                        [5]
            ipv4 rule - tcp_udp_dst_port,
            format : [11,12,23]
```

```
                        "2-5"
                        [5]
            ipv4 rule - icmp_type,
            format : [11,12,23]
                        "2-5"
                        [5]
            ipv4 rule - icmp_message,
            format : ["Echo Reply"]
                        ["Redirect","Parameter Problem","Echo Reply"]).

dropv6( adapterv6 rule ,
            format : "A-B"
                        ["A","B","C"]
                        ["T"]
            ethernetv6 rule - protocol_idv6 ,
            format : ["arp" , "aarp" , "\alias_notation"]
                        [10,2,6]
                        "1-6"
                        [8]
            ethernet rule - vlan_no_v6 ,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - ipv6_src_address,
            format : ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c2","2041:0000:130F:
0000:0000:07C0:853A:140B"]
                        ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c2"]
                        "2001:0db8:0a0b:12f0:0000:0000:0000:0000-2001:0db8:0a0b:
12f0:ffff:ffff:ffff:ffff"

            ipv6 rule - ipv6_dst_address,
            format : ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c3","2041:0000:130F:
0000:0000:07C0:853A:140C"]
                        ["2001:0000:9d38:6ab8:1c48:3a1c:a95a:b1c3"]
                        "2001:0db8:0a0b:12f0:0000:0000:0000:0001-2001:0db8:0a0b:
12f1:0000:0000:0000:0000"

            ipv6 rule - tcp_udp_src_port_v6,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - tcp_udp_dst_port_v6,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - icmpv6_type,
            format : [11,12,23]
                        "2-5"
                        [5]

            ipv6 rule - icmpv6_message,
            format : ["Echo Reply"]
                        ["Redirect","Parameter Problem","Echo Reply"]).



---------------------------------------------------------------------------------------------------
                                Predicate Description
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#incoming_packet(adapterv6(P),
```

ethernetv6(protocol_idv6(Q),
vlan_no_v6(R)),
ipv6(ipv6_src_address(A),ipv6_dst_address(B),
tcp_udp_src_port_v6(C),tcp_udp_dst_port_v6(D), icmpv6(icmpv6_type(E),icmpv6_message(F)),
ip_protocol_no_v6(G))):-

This is the predicate which intakes all the values of the adapterv6(),
ethernetv6( ), ipv4() and ipv6().

#adapterv6(P)
This predicate takes the value of the adapter
to which the connection is to be established

#ethernetv6(protocol_idv6(Q),vlan_no_v6(R))
This predicate takes the value of the protocol_idv6() and vlan_no_v6()
of the type of ethernet the connection is to be established with
---

#ipv6(ipv6_src_address(A),ipv6_dst_address(B),
tcp_udp_src_port_v6(C),tcp_udp_dst_port_v6(D), icmpv6(icmpv6_type(E),icmpv6_message(F)),
ip_protocol_no_v6(G)))

The ipv6 predicate is used to accept the values of the source, destination
ip address(ipv6_src_address(A),ipv6_dst_address(B)), the tcp or udp source and
destination port number (tcp_udp_src_port_v6(C),tcp_udp_dst_port_v6(D)), the icmp type
and message code (icmpv6(icmpv6_type(E),icmpv6_message(F))) and the ip protocol
number(ip_protocol_no_v6(G)).

For ipv4 -

#rejected_adapter(P)

returns true if the adapter(P) has to be rejected.

#rejected_protocol_id(Q)

returns true if the protocol_id(Q) has to be rejected.

#rejected_vlan_no(R)

returns true if the vlan_no(Q) has to be rejected.

#ip_src_address_reject(A)

returns true if the ip_src_address(Q) has to be rejected.

#ip_dst_address_reject(B)

returns true if the ip_dst_address(Q) has to be rejected.

#rejected_tcp_udp_src_port(C)

returns true if the tcp_udp_src_port(C) has to be rejected.

#rejected_tcp_udp_dst_port(C)

returns true if the tcp_udp_src_port(C) has to be rejected.

#reject_icmp_type(E)

returns true if the icmp_type(E) has to be rejected.

#reject_icmp_message(E)

returns true if the icmp_message(E) has to be rejected.

#rejected_IP_protocol_no(G)

returns true if the IP_protocol_no(G) has to be rejected.

#dropped_adapter(P)

returns true if the adapter(P) has to be dropped.

#dropped_protocol_id(Q)

returns true if the protocol_id(Q) has to be dropped.

#dropped_vlan_no(R)

returns true if the vlan_no(Q) has to be dropped.

#ip_src_address_drop(A)

returns true if the ip_src_address(Q) has to be dropped.

#ip_dst_address_drop(B)

returns true if the ip_dst_address(Q) has to be dropped.

#dropped_tcp_udp_src_port(C)

returns true if the tcp_udp_src_port(C) has to be dropped.

#dropped_tcp_udp_dst_port(C)

returns true if the tcp_udp_src_port(C) has to be dropped.

#drop_icmp_type(E)

returns true if the icmp_type(E) has to be dropped.

#drop_icmp_message(E)

returns true if the icmp_message(E) has to be dropped.

#dropped_IP_protocol_no(G)

returns true if the IP_protocol_no(G) has to be dropped.

#allowed_adapter(P)

returns true if the adapter(P) has to be allowed.

#allowed_protocol_id(Q)

returns true if the protocol_id(Q) has to be allowed.

#allowed_vlan_no(R)

returns true if the vlan_no(Q) has to be allowed.

#ip_src_address_accept(A)

returns true if the ip_src_address(Q) has to be allowed.

#ip_dst_address_accept(B)

returns true if the ip_dst_address(Q) has to be allowed.

#allowed_tcp_udp_src_port(C)

returns true if the tcp_udp_src_port(C) has to be allowed.

#allowed_tcp_udp_dst_port(C)

returns true if the tcp_udp_src_port(C) has to be allowed.

#accept_icmp_type(E)

returns true if the icmp_type(E) has to be allowed.

#accept_icmp_message(E)

returns true if the icmp_message(E) has to be allowed.

#allowed_IP_protocol_no(G)

returns true if the IP_protocol_no(G) has to be allowed.

For ipv6 -

#rejected_adapterv6(P)

returns true if the adapterv6(P) has to be rejected.

#rejected_protocol_idv6(Q)

returns true if the protocol_idv6(Q) has to be rejected.

#rejected_vlan_no_v6(R)

returns true if the vlan_no_v6(R) has to be rejected.

#ipv6_src_address_reject(A)

returns true if the ipv6_src_address(Q) has to be rejected.

#ipv6_dst_address_reject(B)

returns true if the ipv6_dst_address(Q) has to be rejected.

#rejected_tcp_udp_src_port_v6(C)

returns true if the tcp_udp_src_port_v6(C) has to be rejected.

#rejected_tcp_udp_dst_port_v6(C)

returns true if the tcp_udp_src_port_v6(C) has to be rejected.

#reject_icmpv6_type(E)

returns true if the icmpv6_type(E) has to be rejected.

#reject_icmpv6_message(E)

returns true if the icmpv6_message(E) has to be rejected.

#rejected_IP_protocol_no_v6(G)

returns true if the IP_protocol_no_v6(G) has to be rejected.

#dropped_adapterv6(P)

returns true if the adapterv6(P) has to be dropped.

#dropped_protocol_idv6(Q)

returns true if the protocol_idv6(Q) has to be dropped.

#dropped_vlan_no_v6(R)

returns true if the vlan_no_v6(Q) has to be dropped.

#ipv6_src_address_drop(A)

returns true if the ipv6_src_address(Q) has to be dropped.

#ipv6_dst_address_drop(B)

returns true if the ipv6_dst_address(Q) has to be dropped.

#dropped_tcp_udp_src_port_v6(C)

returns true if the tcp_udp_src_port_v6(C) has to be dropped.

#dropped_tcp_udp_dst_port_v6(C)

returns true if the tcp_udp_src_port_v6(C) has to be dropped.

#drop_icmpv6_type(E)

returns true if the icmpv6_type(E) has to be dropped.

#drop_icmpv6_message(E)

returns true if the icmpv6_message(E) has to be dropped.

#dropped_IP_protocol_no_v6(G)

returns true if the IP_protocol_no_v6(G) has to be dropped.

#allowed_adapterv6(P)

returns true if the adapter(P) has to be allowed.

#allowed_protocol_idv6(Q)

returns true if the protocol_id(Q) has to be allowed.

#allowed_vlan_no_v6(R)

returns true if the vlan_no(Q) has to be allowed.

#ipv6_src_address_accept(A)

returns true if the ip_src_address(Q) has to be allowed.

#ipv6_dst_address_accept(B)

returns true if the ip_dst_address(Q) has to be allowed.

#allowed_tcp_udp_src_port_v6(C)

returns true if the tcp_udp_src_port(C) has to be allowed.

#allowed_tcp_udp_dst_port_v6(C)

returns true if the tcp_udp_src_port(C) has to be allowed.

#accept_icmpv6_type(E)

returns true if the icmp_type(E) has to be allowed.

#accept_icmpv6_message(E)

returns true if the icmp_message(E) has to be allowed.

#allowed_IP_protocol_no_v6(G)

returns true if the IP_protocol_no(G) has to be allowed.

Predefined Predicates :

```
string(L).
split_string(L,"-","",[H|[T|_]]).
atom_number(H,W1).
member(X,[P|Q]).
string_concat(SS2,SSS2,T2)
between(N2,N1,Xn)
write().
```

****
Query Description
****

The program has only one predicate to query :

```
incoming_packet(adapter(P),
                ethernet(protocol_id(Q),vlan_no(R)),
                ipv6(ipv6_src_address(A),ipv6_dst_address(B),
tcp_udp_src_port_v6(C),tcp_udp_dst_port_v6(D),
                icmpv6(icmpv6_type(E),icmpv6_message(F)), ip_protocol_no_v6(G))).
```

Note :

#Here, if any field is left blank, for eg adapter(_), the package is rejected
because the rejected predicate has been given the highest priority.

#Here, if any such value is given which is not specified in the allow(),reject()

or the drop() predicate in the database, the default output wil be false.
