# Configure IKEv2 IPv6 Site-to-Site Tunnel Between ASA and FTD

## Contents



## Introduction

This document provides a configuration example to set up an IPv6 site to site tunnel between an ASA (Adaptive Security Appliance) and FTD (Firepower Threat Defense) using Internet Key Exchange version 2 (IKEv2) protocol. The setup includes end to end IPv6 network connectivity with ASA and FTD as VPN terminating devices.

## Prerequisites

### Requirements

Cisco recommends that you have knowledge of these topics :

- Fundamental knowledge of ASA CLI configuration
- Fundamental knowledge of IKEv2 and IPSEC protocols
- Understanding of IPv6 addressing and routing
- Basic understanding of FTD configuration via FMC

### Components Used

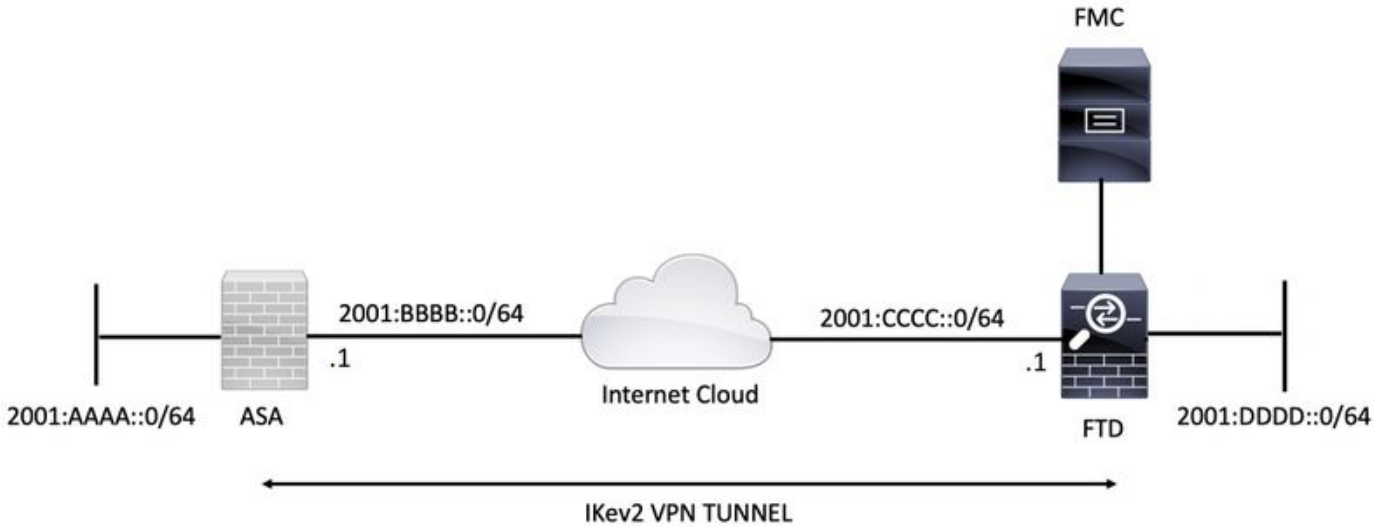
The information in this document is based on a virtual environment, created from devices in a specific lab setup. All of the devices used in this document started with a cleared (default) configuration. If your network is in production, make sure that you understand the potential impact of any command.

The information in this document is based on these software and hardware versions:

- Cisco ASAv running 9.6.(4)12
- Cisco FTDv running 6.5.0
- Cisco FMCv running 6.6.0

# Configure

## Network Diagram




## ASA Configuration

This section describes the configuration required on the ASA.

Step 1. Configure the ASA interfaces.

```
interface GigabitEthernet0/0
nameif outside
security-level 0
ipv6 address 2001:bbbb::1/64
ipv6 enable

interface GigabitEthernet0/1
nameif inside
security-level 100
ipv6 address 2001:aaaa::1/64
ipv6 enable
```

Step 2. Set an IPv6 default route.

```
ipv6 route outside ::/0 2001:bbbb::2
```

Step 3. Configure the IKEv2 Policy and enable IKEv2 on the outside interface.

```
crypto ikev2 policy 1
encryption aes-256
integrity sha256
group 14
prf sha256
lifetime seconds 86400

crypto ikev2 enable outside
```

Step 4. Configure the Tunnel Group.

```
tunnel-group 2001:cccc::1 type ipsec-l2l
tunnel-group 2001:cccc::1 ipsec-attributes
ikev2 remote-authentication pre-shared-key cisco123
ikev2 local-authentication pre-shared-key cisco123
```

Step 5. Create the objects and the Access Control List (ACL) to match the interesting traffic.

```
object-group network local-network
network-object 2001:aaaa::/64

object-group network remote-network
network-object 2001:dddd::/64

access-list CRYPTO_ACL extended permit ip object-group local-network object-group remote-network
```

Step 6. Configure the identity Network Address Translation (NAT) rules for the interesting traffic.

```
nat (inside,outside) source static local-network local-network destination static remote-network
remote-network no-proxy-arp route-lookup
```

Step 7. Configure the IKEv2 IPSec Proposal.

```
crypto ipsec ikev2 ipsec-proposal ikev2_aes256
protocol esp encryption aes-256
protocol esp integrity sha-1
```

Step 8. Set the Crypto Map and apply it to the outside interface.

```
crypto map VPN 1 match address CRYPTO_ACL
crypto map VPN 1 set peer 2001:cccc::1
crypto map VPN 1 set ikev2 ipsec-proposal ikev2_aes256
crypto map VPN 1 set reverse-route

crypto map VPN interface outside
```

## FTD Configuration

This section provides instructions to configure an FTD using FMC.

### Define the VPN Topology

Step 1. Navigate to **Devices > VPN > Site To Site.**

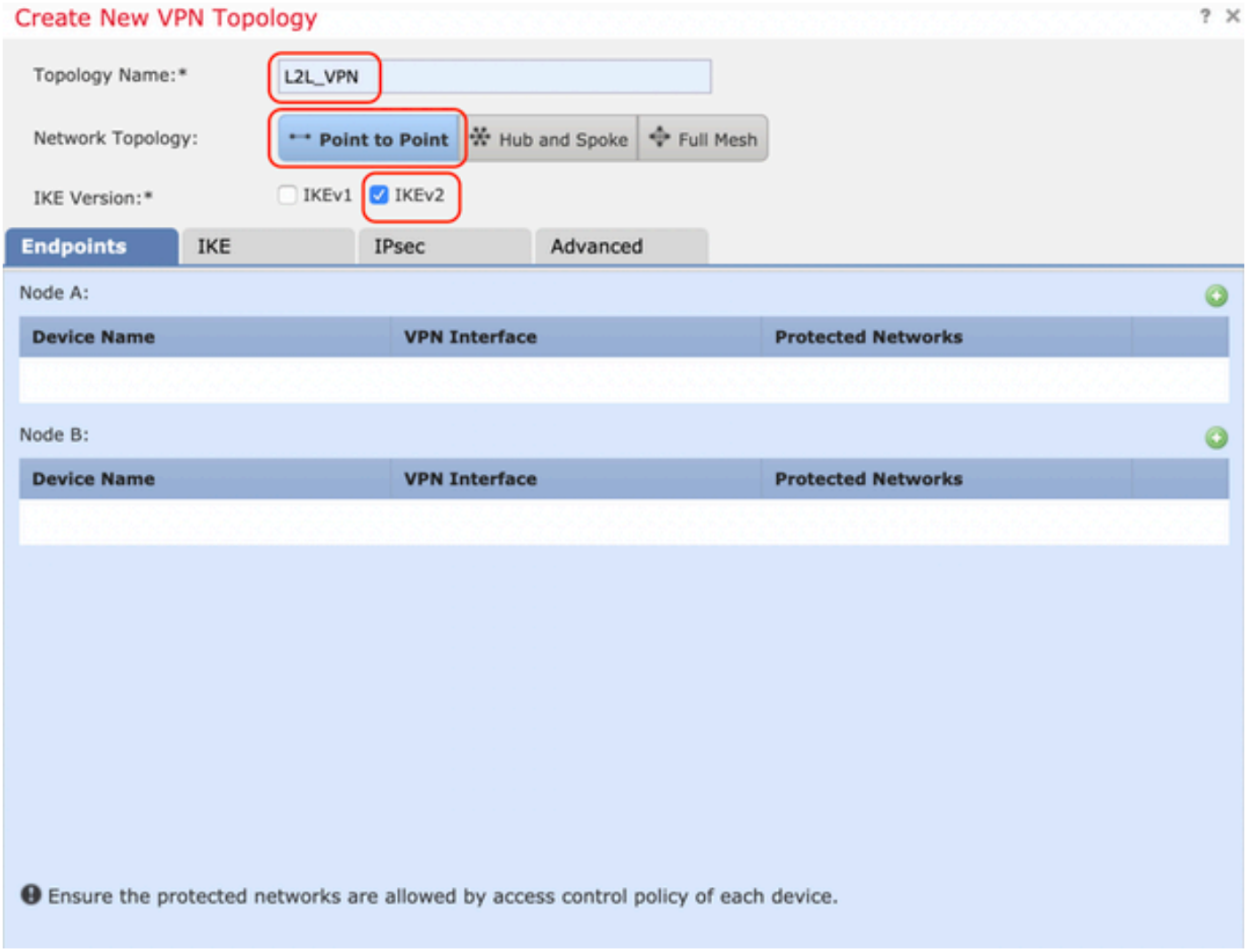
Select 'Add VPN' and choose 'Firepower Threat Defense Device', as shown in this image.


Step 2. 'Create New VPN Topology' box appears. Give the VPN an easily identifiable name.

Network Topology: Point to Point

IKE Version: IKEv2

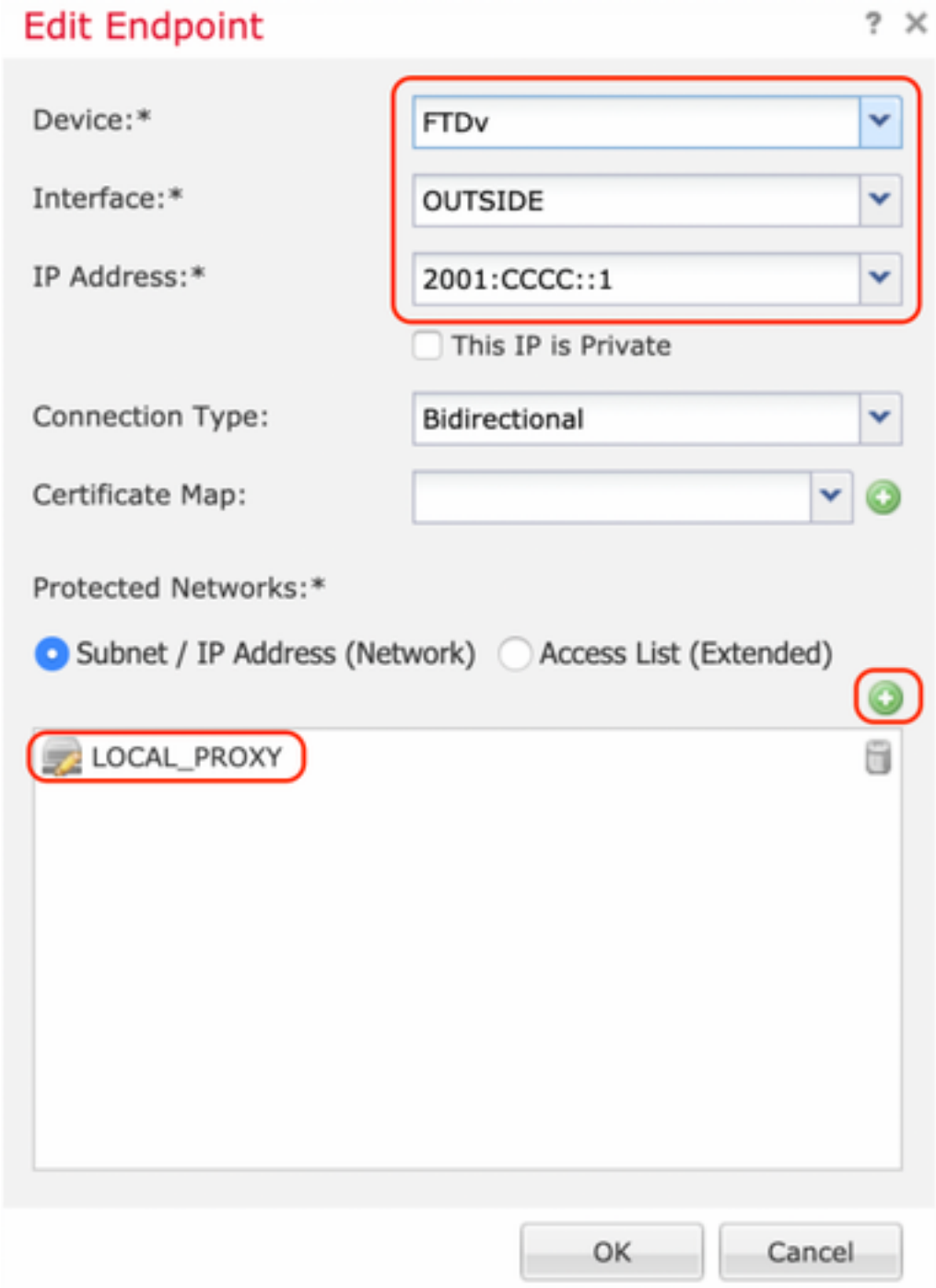
In this example, when selecting endpoints Node A is the FTD. Node B is the ASA. Click on the green plus button to add devices to the topology.

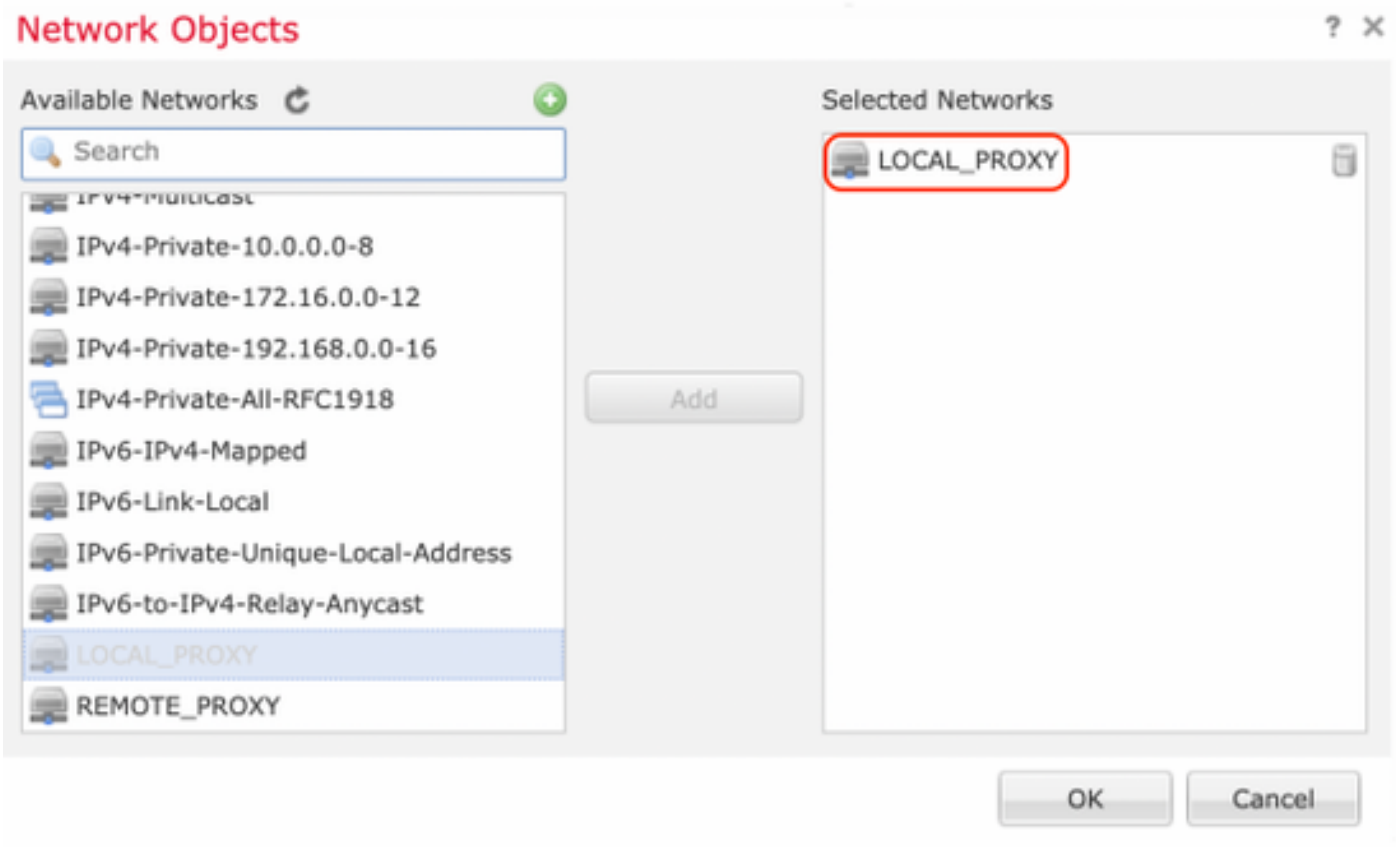



Step 3. Add the FTD as the first endpoint.

Choose the interface where the crypto map is applied. The IP address should auto-populate from the device configuration.

Click the green plus icon under Protected Networks to select subnets that are encrypted via this VPN tunnel. In this example, 'Local Proxy' network object on FMC comprises of IPv6 subnet '2001:DDDD::/64'.

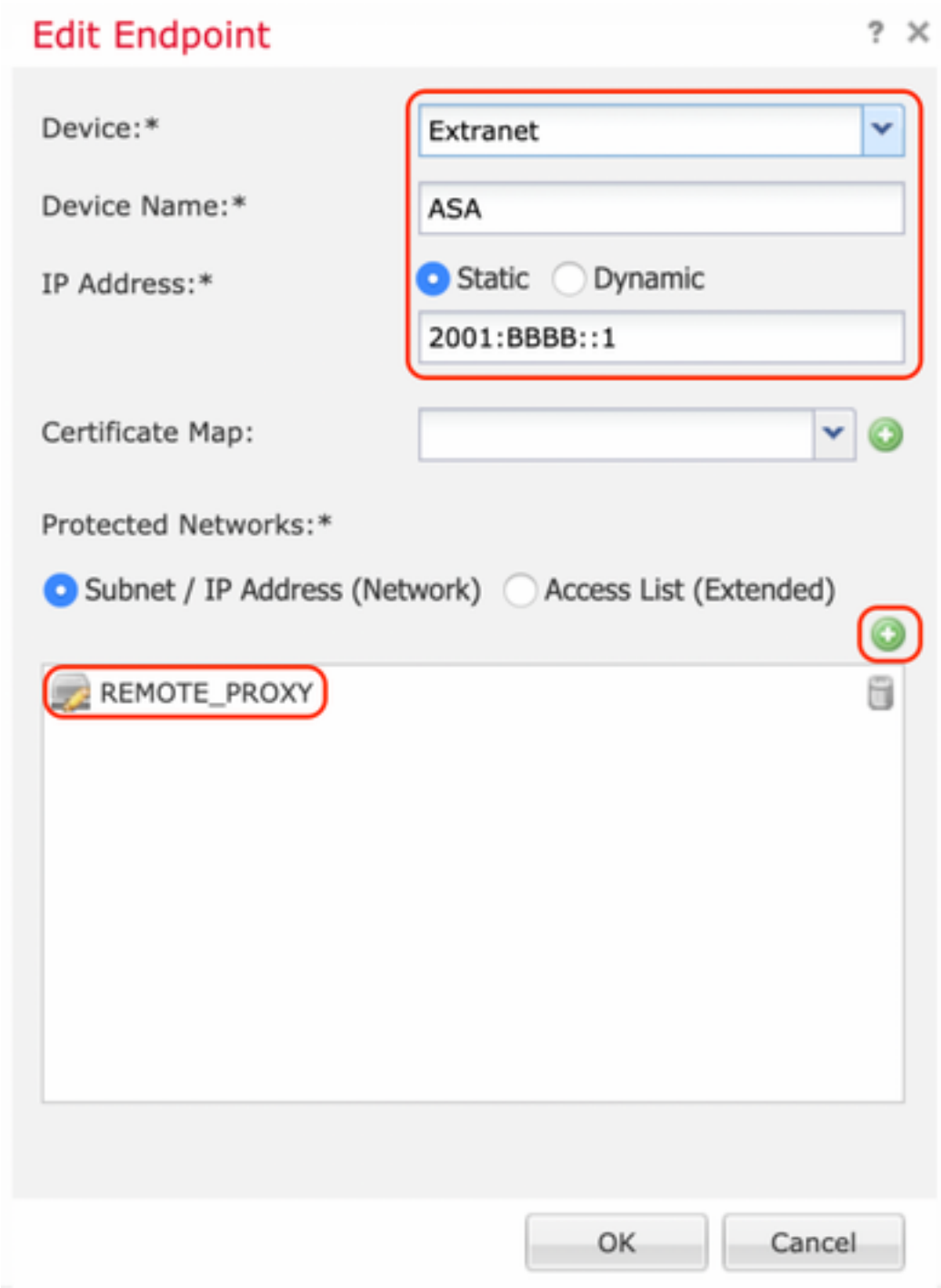

Edit Endpoint
Device:*
FTDv
Interface:*
OUTSIDE
IP Address:*
2001:CCCC::1
This IP is Private
Connection Type:
Bidirectional
Certificate Map:
Protected Networks:*
Subnet / IP Address (Network)
Access List (Extended)
LOCAL_PROXY
OK
Cancel




With the above step, the FTD endpoint configuration is complete.

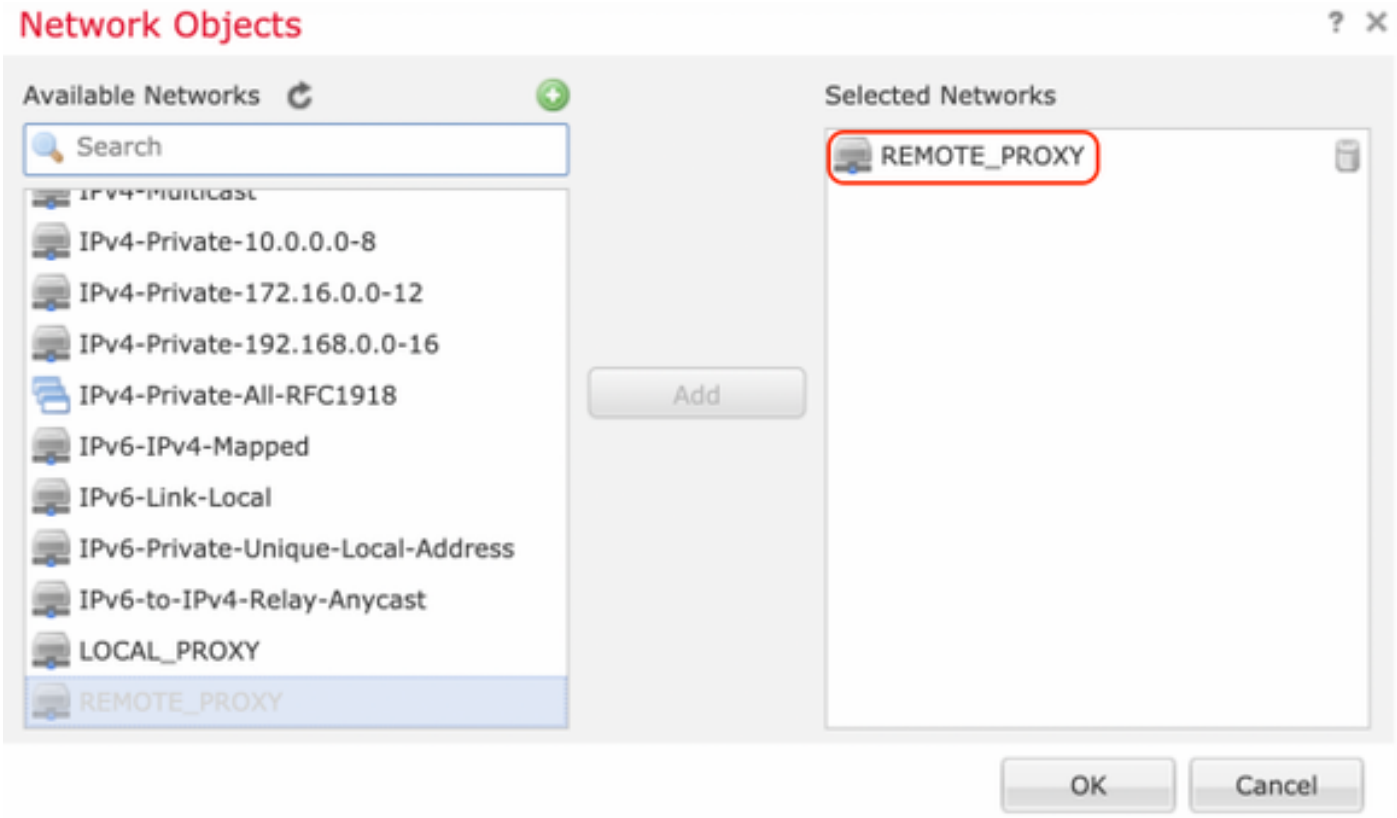
Step 4. Click the green plus icon for Node B which is an ASA in the configuration example. Devices that are not managed by the FMC are considered Extranet. Add a device name and IP address.

Step 5. Select the green plus icon to add protected networks.



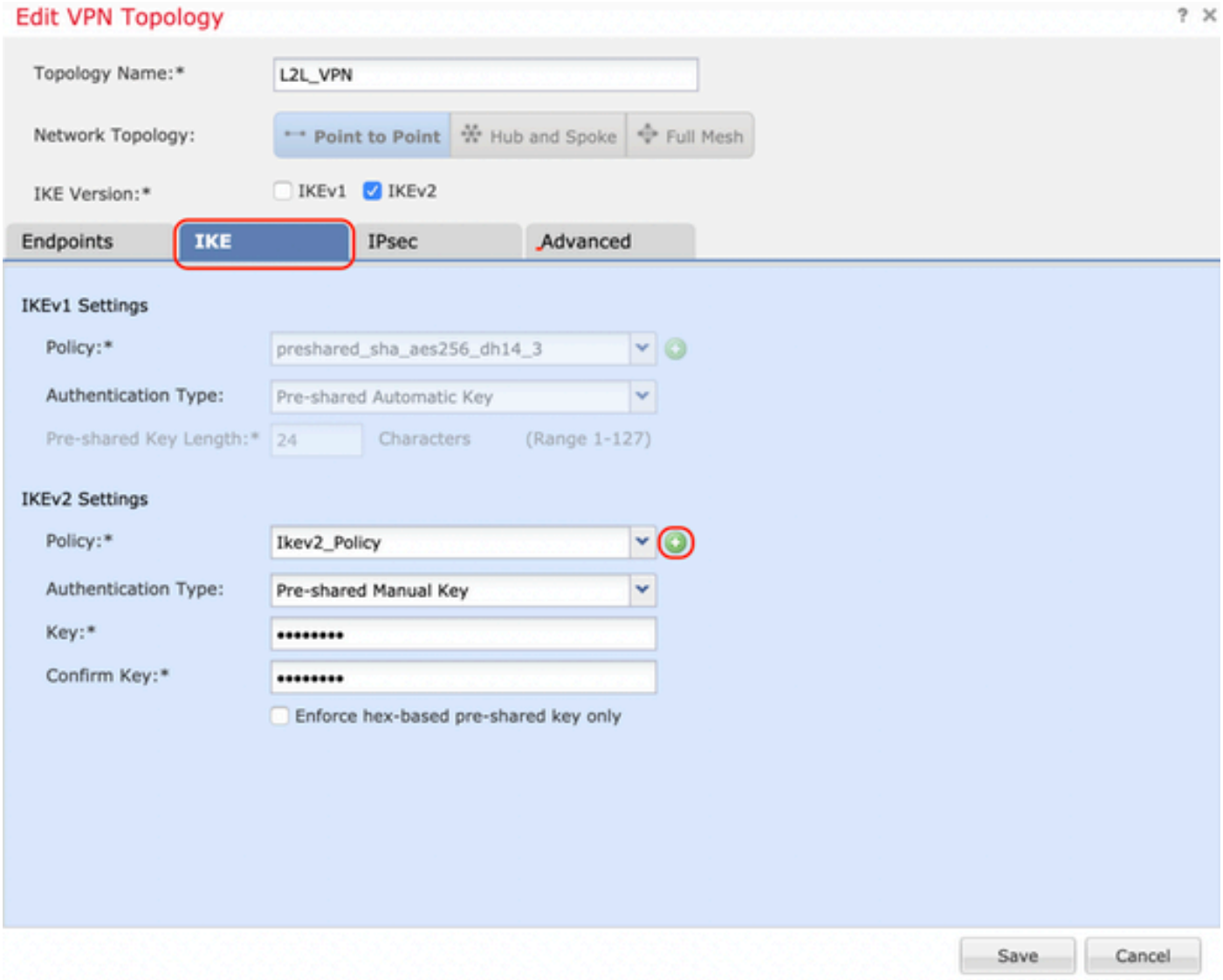

Step 6. Select the ASA subnets that need to be encrypted and add them to the selected networks.

'Remote Proxy' is the ASA subnet '2001:AAAA::/64' in this example.




**Configure IKE Parameters**

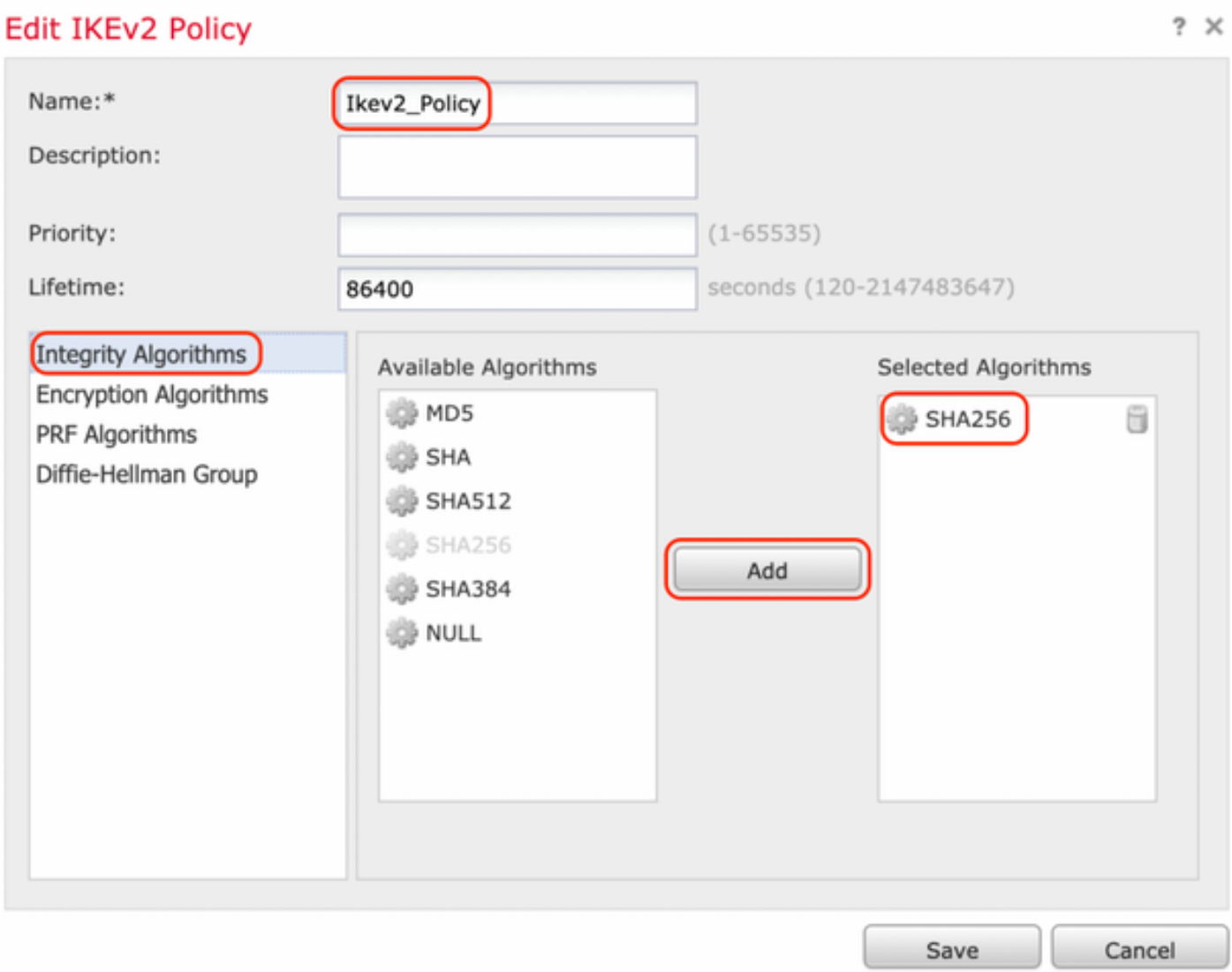
Step 1. Under the IKE tab, specify the parameters to use for the IKEv2 initial exchange. Click the green plus icon to create a new IKE policy.

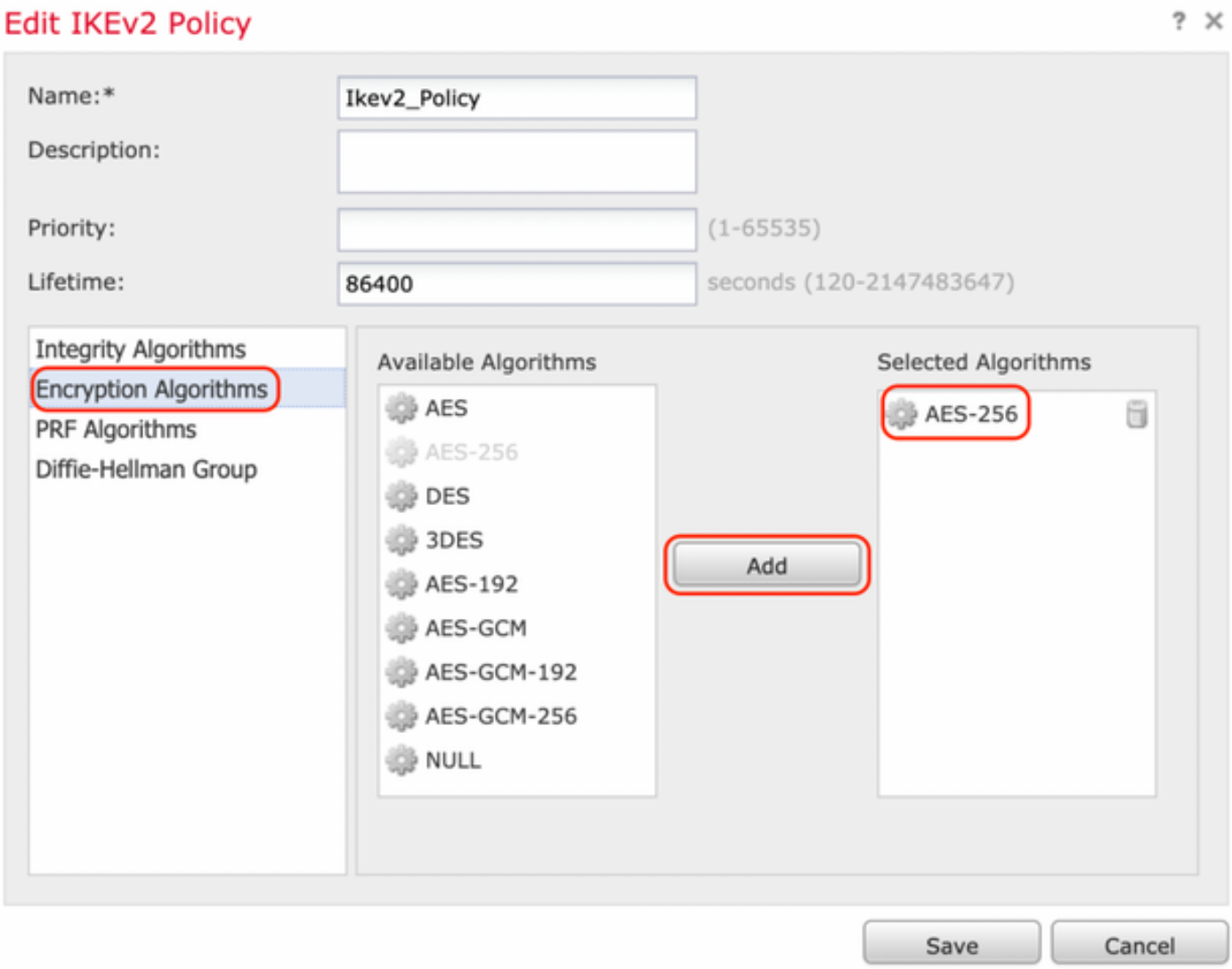


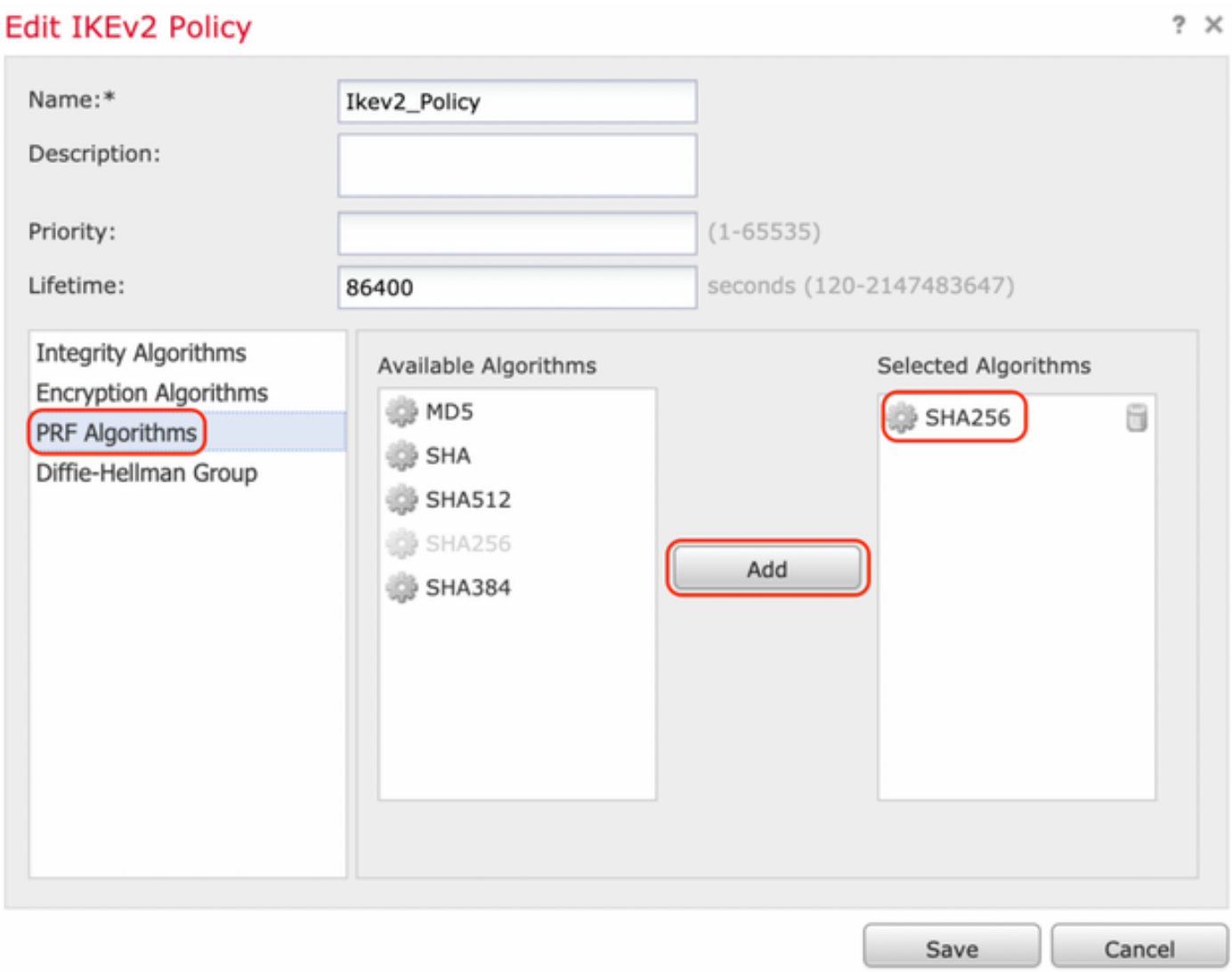

Step 2. In the new IKE policy, specify a priority number as well as the lifetime of phase 1 of the connection. This guide uses these parameters for the initial exchange:
Integrity (SHA256),
Encryption (AES-256),
PRF (SHA256), and
Diffie-Hellman Group (Group 14).

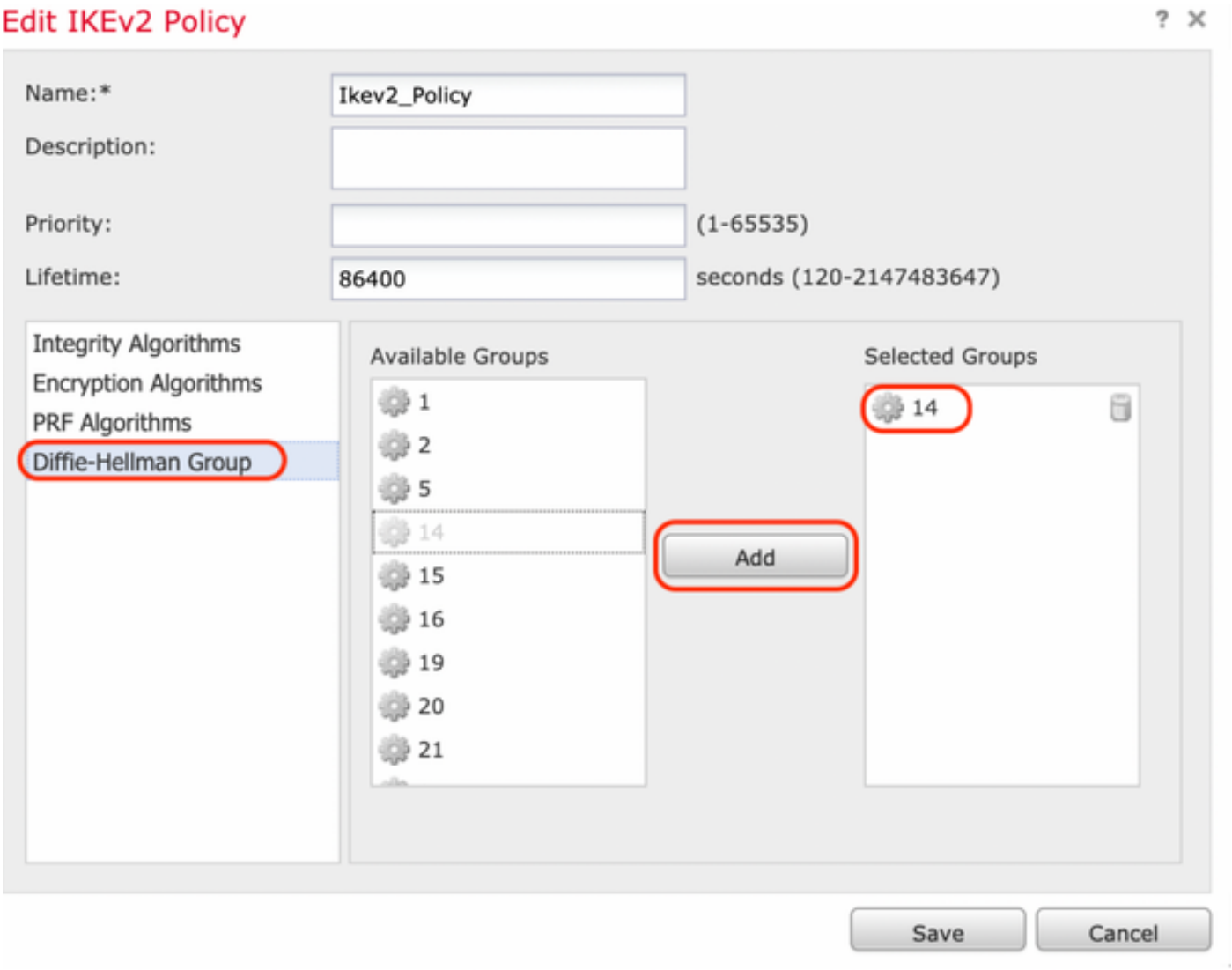
All IKE policies on the device will be sent to the remote peer regardless of what is in the selected policy section. The first one the remote peer matches will be selected for the VPN connection.

[Optional] Choose which policy is sent first using the priority field. Priority 1 is sent first.


Edit IKEv2 Policy
Name:*
Ikev2_Policy
Description:
Priority:
(1-65535)
Lifetime:
86400
seconds (120-2147483647)
Integrity Algorithms
Encryption Algorithms
PRF Algorithms
Diffie-Hellman Group
Available Algorithms
MD5
SHA
SHA512
SHA256
SHA384
NULL
Add
Selected Algorithms
SHA256
Save
Cancel

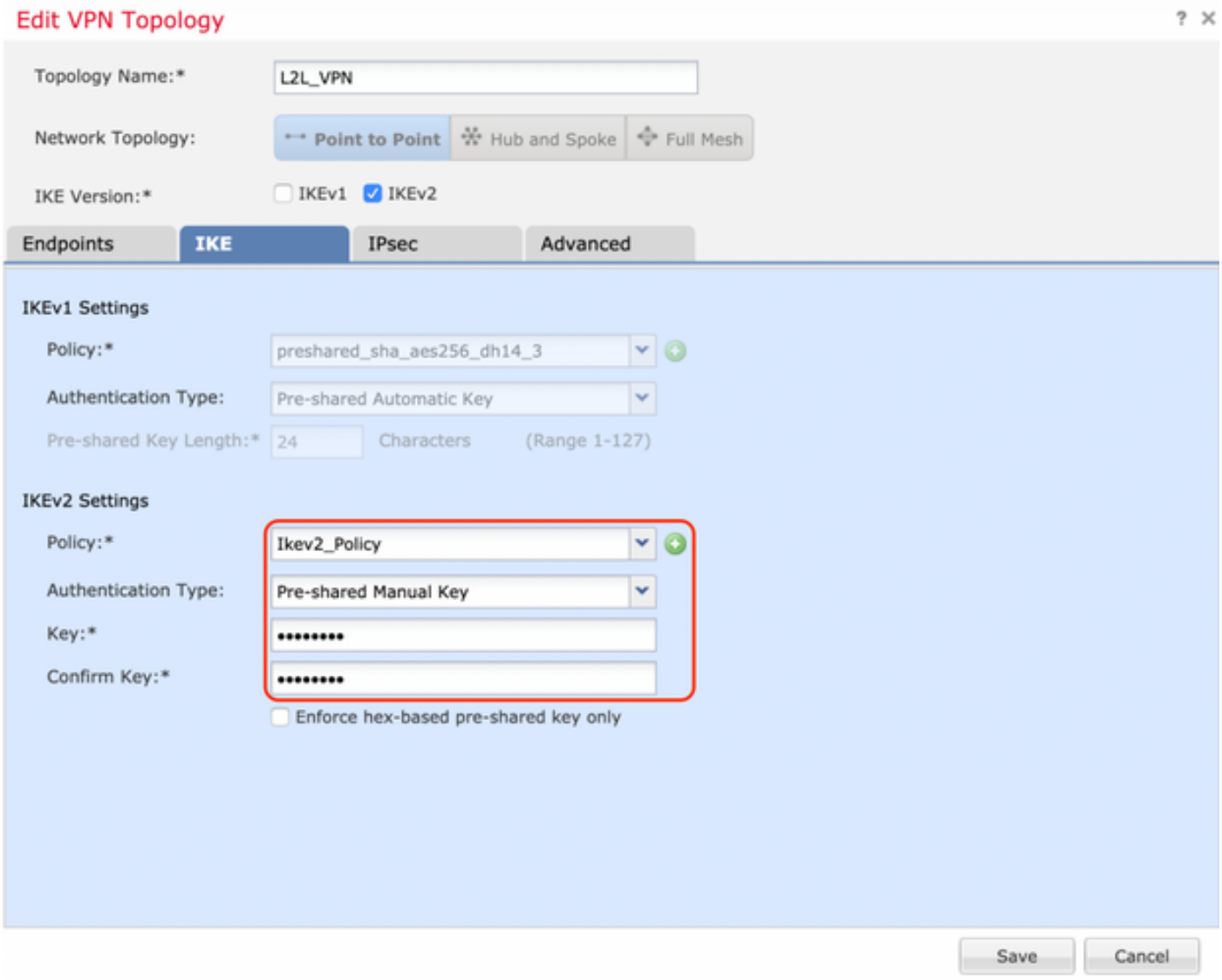

Edit IKEv2 Policy
Name:*
Ikev2_Policy
Description:
Priority:
(1-65535)
Lifetime:
86400
seconds (120-2147483647)
Integrity Algorithms
Encryption Algorithms
PRF Algorithms
Diffie-Hellman Group
Available Algorithms
AES
AES-256
DES
3DES
AES-192
AES-GCM
AES-GCM-192
AES-GCM-256
NULL
Add
Selected Algorithms
AES-256
Save
Cancel


Edit IKEv2 Policy
Name:*
Ikev2_Policy
Description:
Priority:
(1-65535)
Lifetime:
86400
seconds (120-2147483647)
Integrity Algorithms
Encryption Algorithms
PRF Algorithms
Diffie-Hellman Group
Available Algorithms
MD5
SHA
SHA512
SHA256
SHA384
Add
Selected Algorithms
SHA256
Save
Cancel



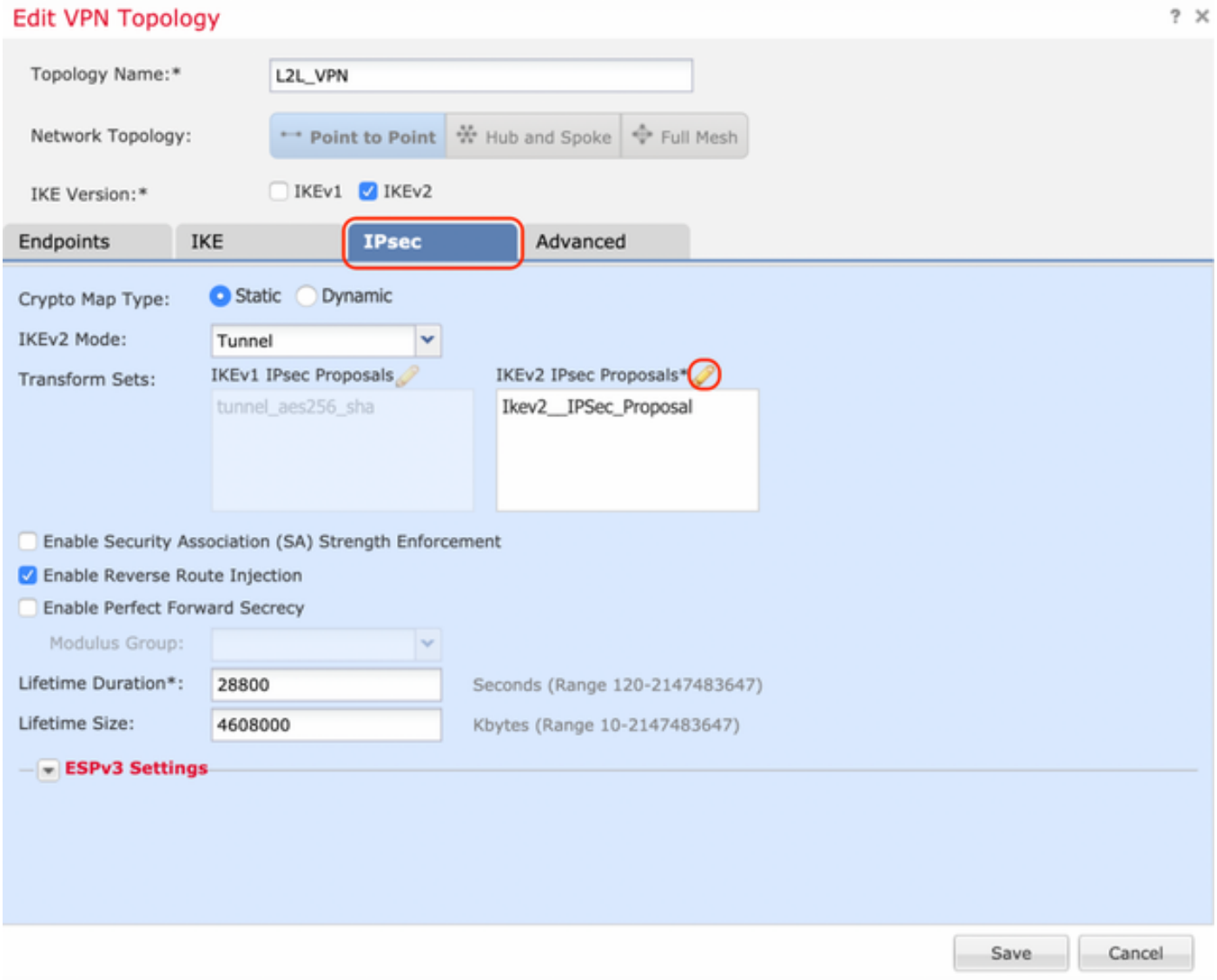

Step 3. Once the parameters have been added, select the above-configured policy, and choose the authentication type.

Select the Pre-shared Manual Key option. For this guide, the pre-shared key '**cisco123**' is used.




## Configure IPSEC Parameters

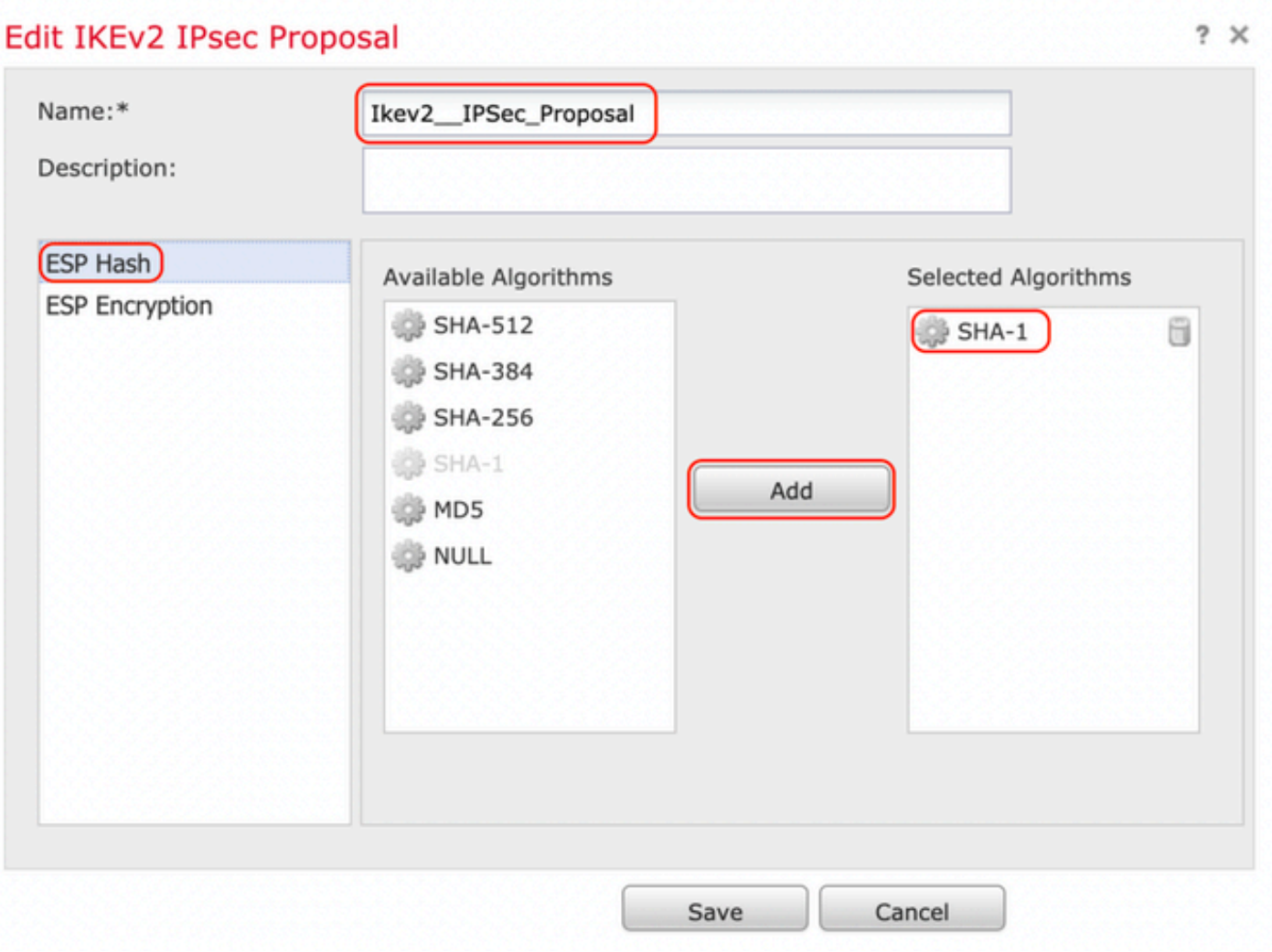
Step 1. Move to the IPsec tab and create a new IPsec Proposal by clicking the pencil icon to edit the transform set.

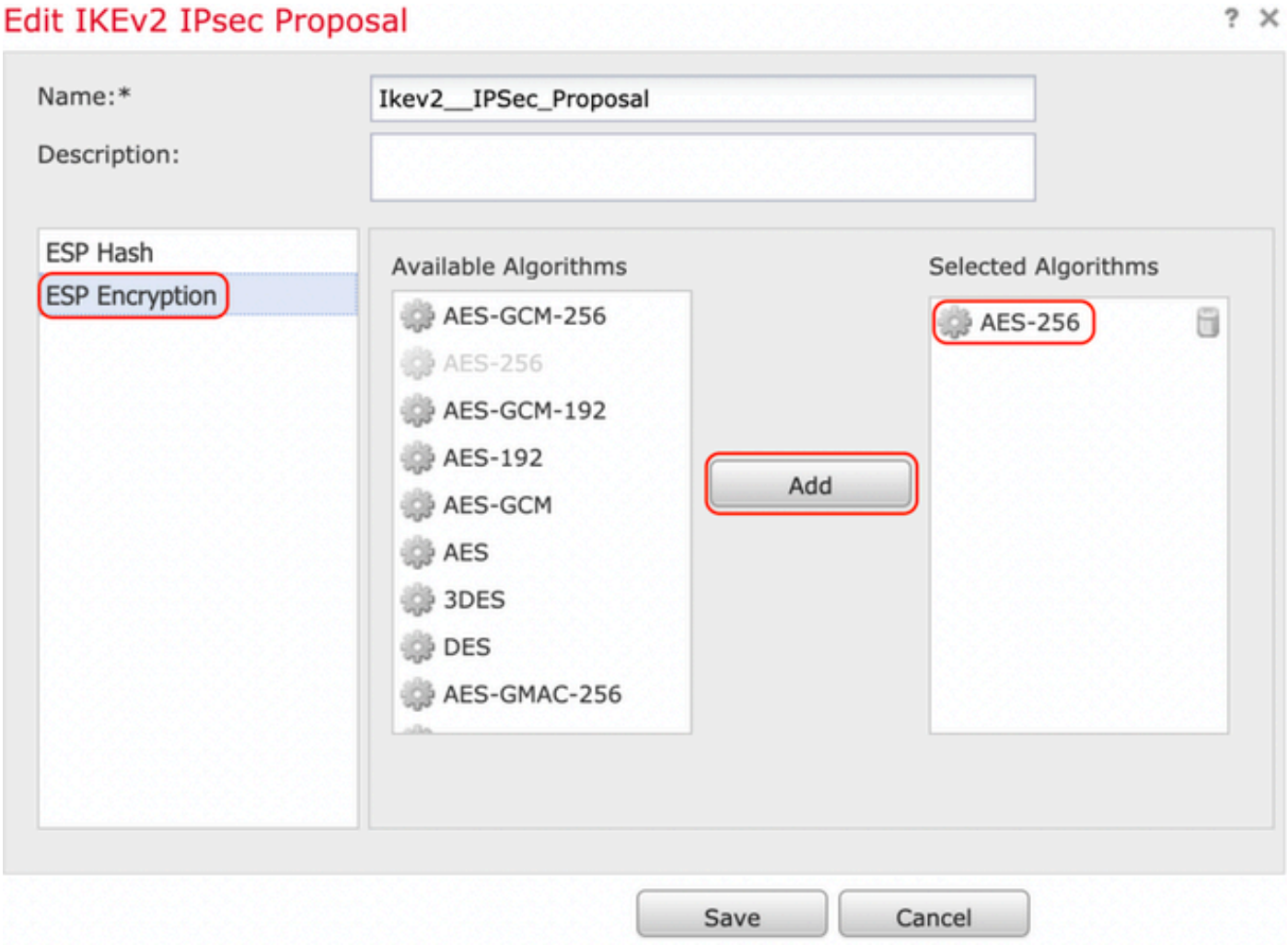



Step 2. Create a new IKEv2 IPsec Proposal by selecting the green plus icon and input the phase 2 parameters as shown below:

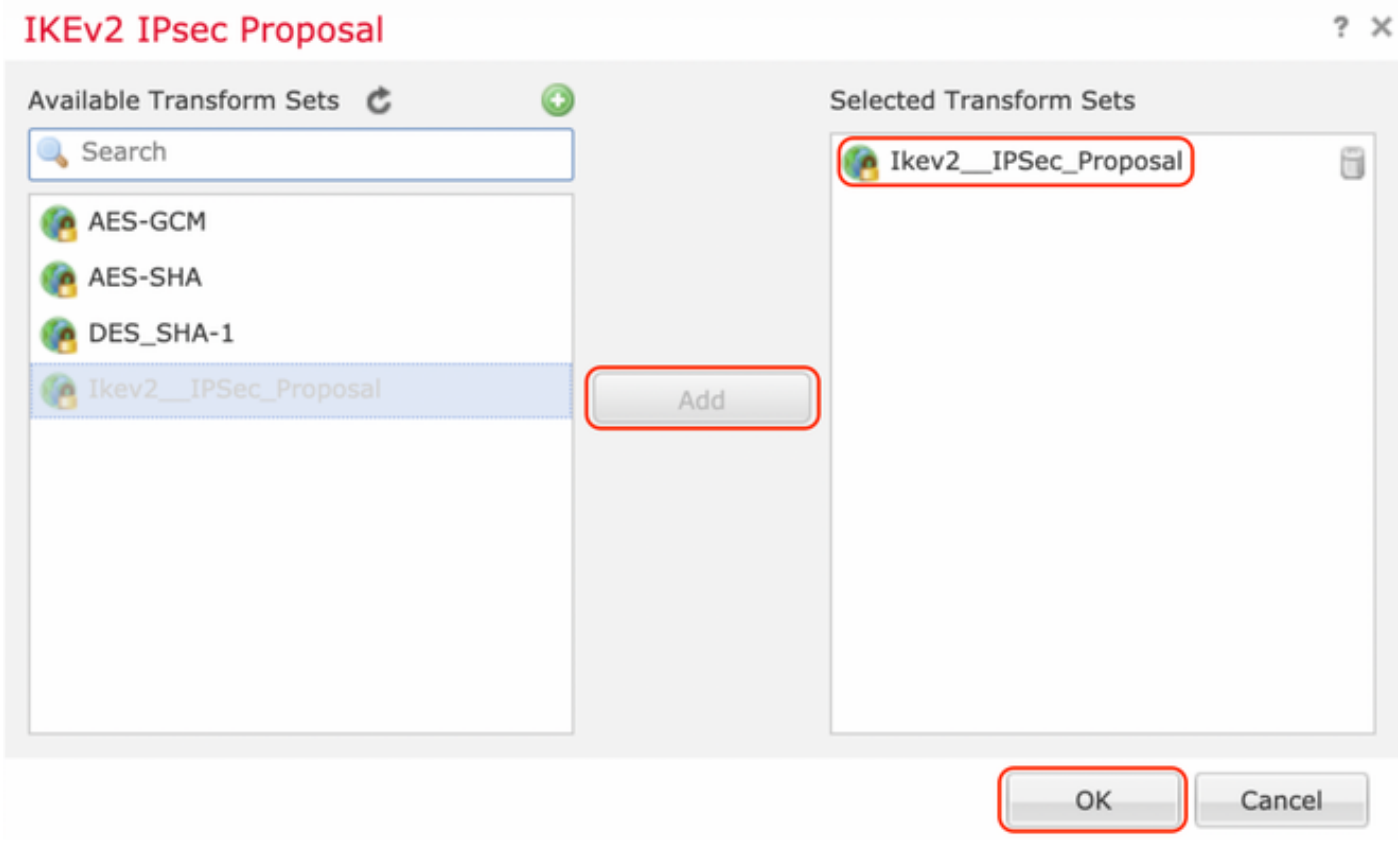
ESP Hash: SHA-1

ESP Encryption : AES-256


Edit IKEv2 IPsec Proposal
Name:*
Ikev2__IPSec_Proposal
Description:
ESP Hash
ESP Encryption
Available Algorithms
SHA-512
SHA-384
SHA-256
SHA-1
MD5
NULL
Add
Selected Algorithms
SHA-1
Save
Cancel

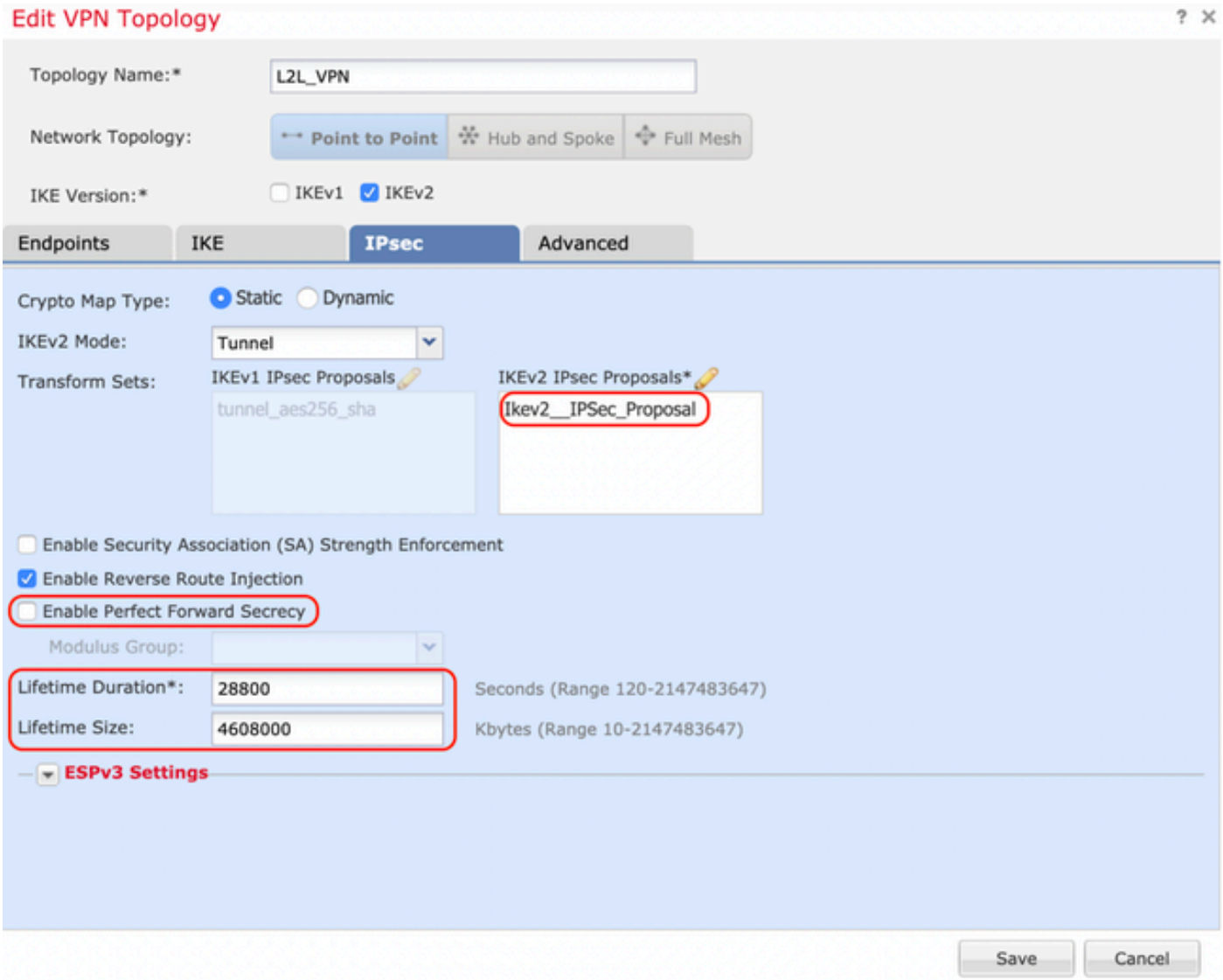



Step 3. Once the new IPsec proposal has been created, add it to the selected transform sets.




Step 4. The newly selected IPsec proposal is now listed under the IKEv2 IPsec Proposals.

If needed, the phase 2 lifetime and PFS can be edited here. For this example, the lifetime is set as default and PFS disabled.



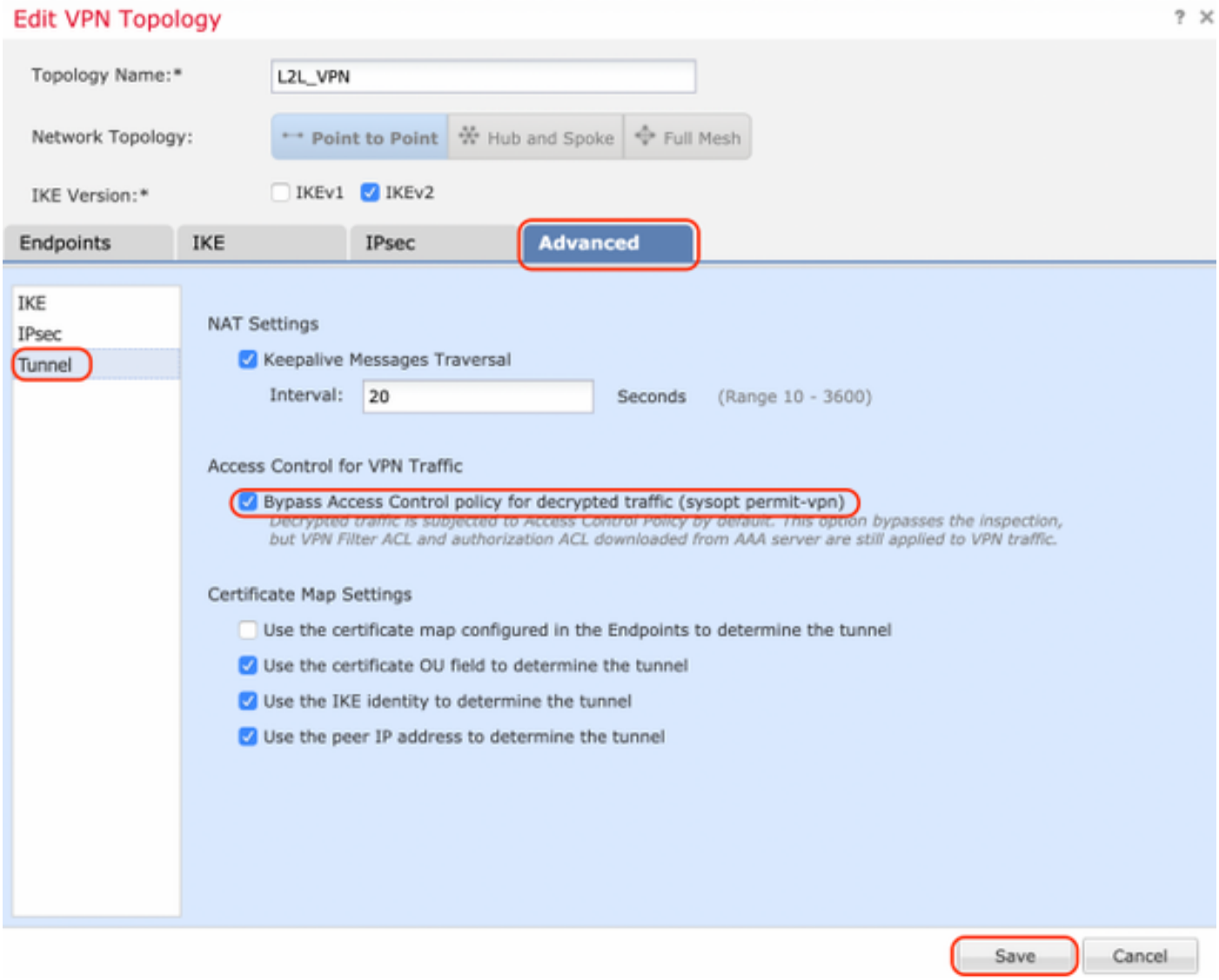

You must either configure the below steps to Bypass Access Control or Create Access Control Policy rules to allow VPN subnets through FTD.

## Bypass Access Control

If *sysopt permit-vpn* is not enabled then an access control policy must be created to allow the VPN traffic through the FTD device. If sysopt permit-vpn is enabled skip creating an access control policy. This configuration example uses the “Bypass Access Control” option.

The parameter *sysopt permit-vpn* can be enabled under the Advanced > Tunnel.

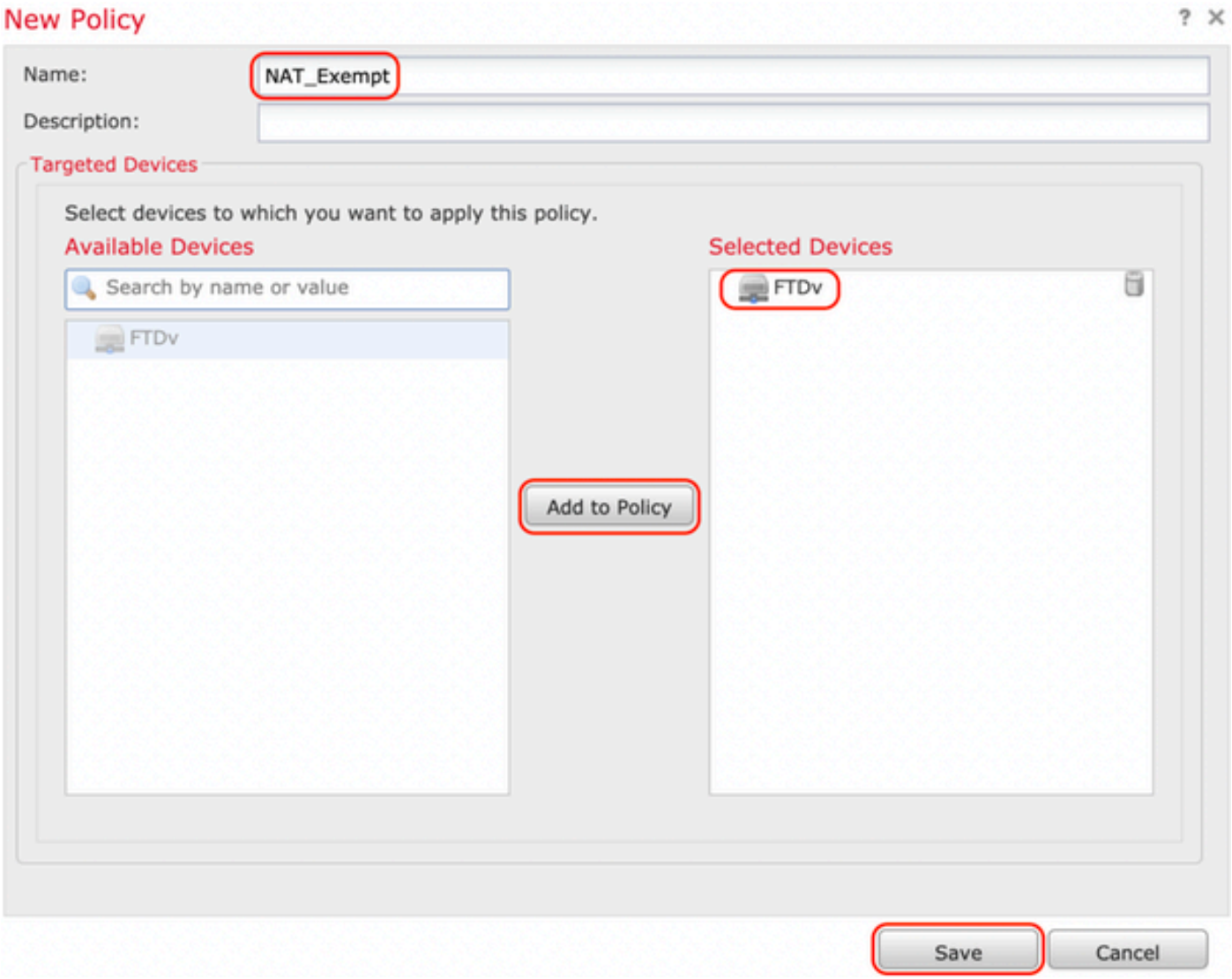
> **Caution**: This option removes the possibility to use the Access Control Policy to inspect traffic coming from the users. VPN filters or downloadable ACLs can still be used to filter user traffic. This is a global command and applies to all VPNs if this checkbox is enabled.



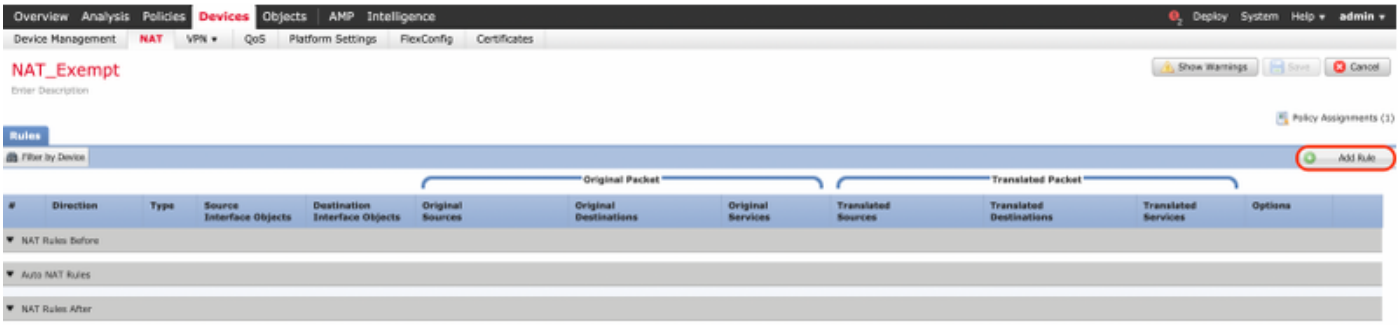

# Configure NAT Exemption

Configure a NAT Exemption statement for the VPN traffic. NAT exemption must be in place to prevent VPN traffic from matching another NAT statement and incorrectly translating VPN traffic.

Step 1. Navigate to **Devices > NAT** and create a new policy by clicking **New Policy > Threat Defense NAT**.



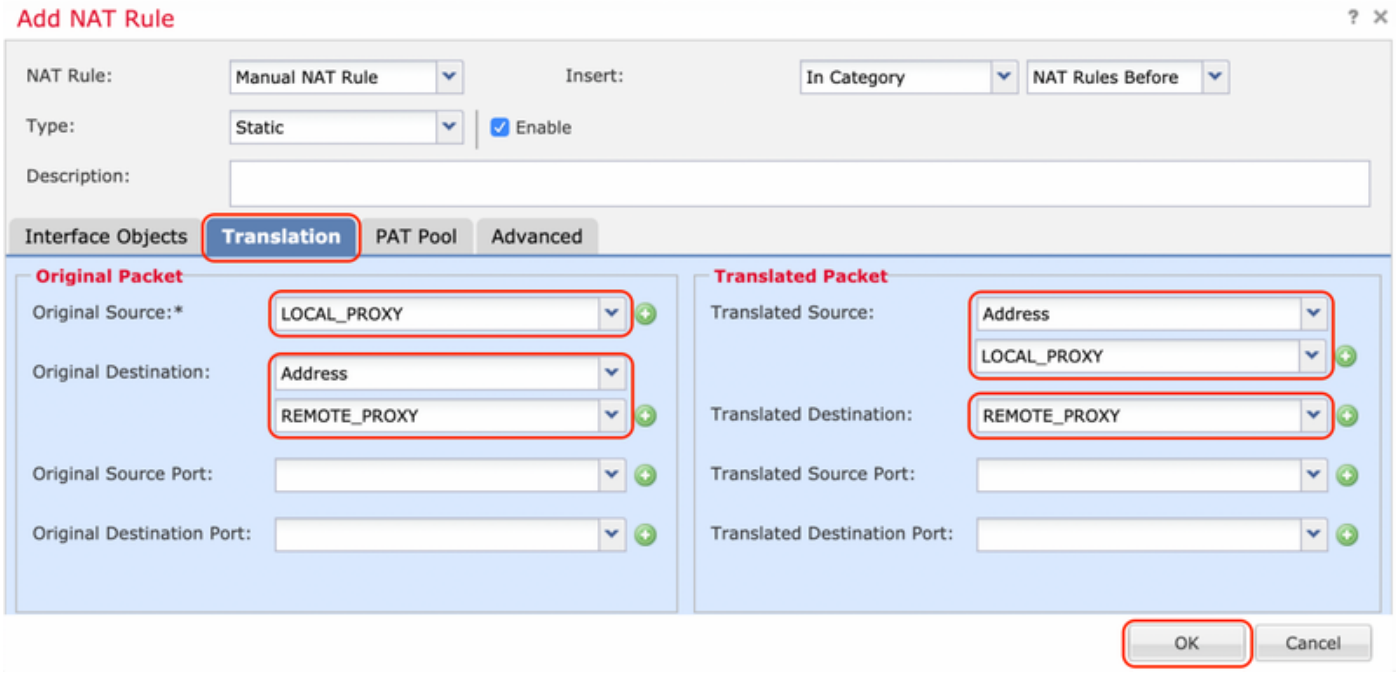

Step 2. Click on **Add Rule**.



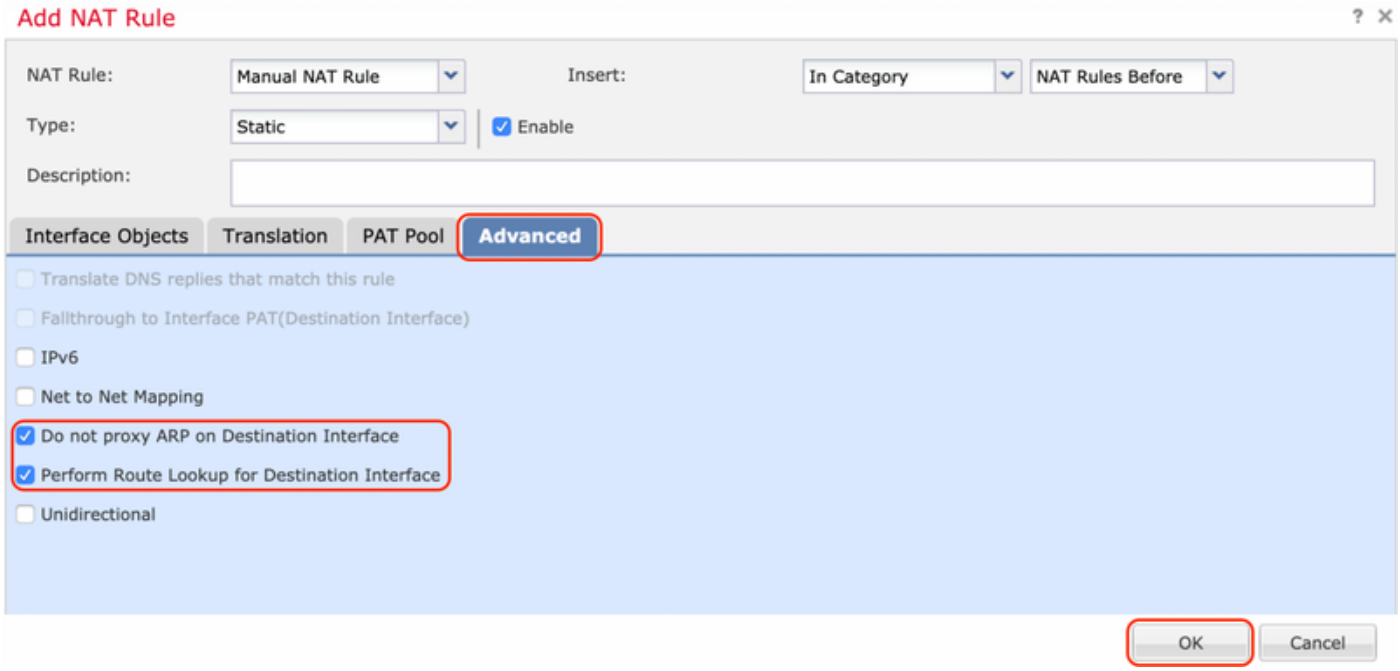

Step 3. Create a new Static Manual NAT Rule.

Reference the inside and outside interfaces for the NAT rule. Specifying the interfaces at Interface Objects tab prevents these rules to affect traffic from other interfaces.

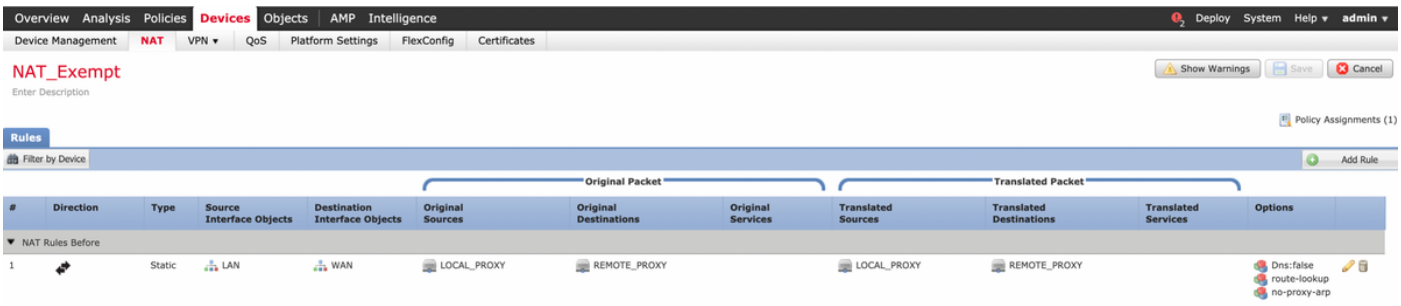
Navigate to the Translation tab and select the source and destination subnets. As this is a NAT exemption rule, ensure the original source/destination and the translated source/destination are the same.



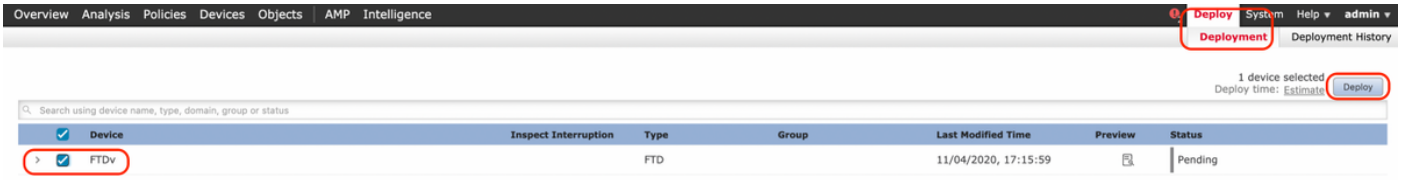

Click the Advanced tab and enabled **no-proxy-arp** and **route-lookup.**




Save this rule and confirm the final NAT statement in the NAT list.




**Step 4. Once the configuration is complete, save and deploy the configuration to the FTD.**




# Verify

Initiate interesting traffic from the LAN machine or you can run the below packet-tracer command on the ASA.

```
packet-tracer input inside icmp 2001:aaaa::23 128 0 2001:dddd::33 detail
```

**Note :** Here Type = 128 and Code=0 represents ICMPv6 “Echo Request”.

The below section describes the commands that you can run on ASAv or FTD LINA CLI to check the status of the IKEv2 tunnel.

This is an example of an output from the ASA:

```
ciscoasa# show crypto ikev2 sa

IKEv2 SAs:

Session-id:3, Status:UP-ACTIVE, IKE count:1, CHILD count:1

Tunnel-id Local                                                 Remote
                      Status         Role
  6638313 2001:bbbb::1/500                                      2001:cccc::1/500
                      READY    INITIATOR
      Encr: AES-CBC, keysize: 256, Hash: SHA256, DH Grp:14, Auth sign: PSK, Auth verify: PSK
      Life/Active Time: 86400/224 sec
Child sa: local selector  2001:aaaa::/0 - 2001:aaaa::ffff:ffff:ffff:ffff/65535
          remote selector 2001:dddd::/0 - 2001:dddd::ffff:ffff:ffff:ffff/65535
          ESP spi in/out: 0xa0fd3fe6/0xd95ecdb8


ciscoasa# show crypto ipsec sa detail
interface: outside
    Crypto map tag: VPN, seq num: 1, local addr: 2001:bbbb::1

      access-list CRYPTO_ACL extended permit ip 2001:aaaa::/64 2001:dddd::/64
      local ident (addr/mask/prot/port): (2001:aaaa::/64/0/0)
      remote ident (addr/mask/prot/port): (2001:dddd::/64/0/0)
      current_peer: 2001:cccc::1

      #pkts encaps: 11, #pkts encrypt: 11, #pkts digest: 11
      #pkts decaps: 11, #pkts decrypt: 11, #pkts verify: 11
      #pkts compressed: 0, #pkts decompressed: 0
      #pkts not compressed: 0, #pkts comp failed: 0, #pkts decomp failed: 0
      #pre-frag successes: 0, #pre-frag failures: 0, #fragments created: 0
      #PMTUs sent: 0, #PMTUs rcvd: 0, #decapsulated frgs needing reassembly: 0
      #TFC rcvd: 0, #TFC sent: 0
      #Valid ICMP Errors rcvd: 0, #Invalid ICMP Errors rcvd: 0
      #pkts no sa (send): 0, #pkts invalid sa (rcv): 0
      #pkts encaps failed (send): 0, #pkts decaps failed (rcv): 0
      #pkts invalid prot (rcv): 0, #pkts verify failed: 0
      #pkts invalid identity (rcv): 0, #pkts invalid len (rcv): 0
```

```
      #pkts invalid pad (rcv): 0,
      #pkts invalid ip version (rcv): 0,
      #pkts replay rollover (send): 0, #pkts replay rollover (rcv): 0
      #pkts replay failed (rcv): 0
      #pkts min mtu frag failed (send): 0, #pkts bad frag offset (rcv): 0
      #pkts internal err (send): 0, #pkts internal err (rcv): 0

      local crypto endpt.: 2001:bbbb::1/500, remote crypto endpt.: 2001:cccc::1/500
      path mtu 1500, ipsec overhead 94(64), media mtu 1500
      PMTU time remaining (sec): 0, DF policy: copy-df
      ICMP error validation: disabled, TFC packets: disabled
      current outbound spi: D95ECDB8
      current inbound spi : A0FD3FE6

    inbound esp sas:
      spi: 0xA0FD3FE6 (2700951526)
         transform: esp-aes-256 esp-sha-hmac no compression
         in use settings ={L2L, Tunnel, IKEv2, }
         slot: 0, conn_id: 1937408, crypto-map: VP
         sa timing: remaining key lifetime (kB/sec): (4055040/28535)
         IV size: 16 bytes
         replay detection support: Y
         Anti replay bitmap:
          0x00000000 0x00000001
    outbound esp sas:
      spi: 0xD95ECDB8 (3646868920)
         transform: esp-aes-256 esp-sha-hmac no compression
         in use settings ={L2L, Tunnel, IKEv2, }
         slot: 0, conn_id: 1937408, crypto-map: VPN
         sa timing: remaining key lifetime (kB/sec): (4193280/28535)
         IV size: 16 bytes
         replay detection support: Y
         Anti replay bitmap:
          0x00000000 0x00000001


ciscoasa# show vpn-sessiondb detail l2l filter name 2001:cccc::1

Session Type: LAN-to-LAN Detailed

Connection   : 2001:cccc::1
Index        : 473                    IP Addr      : 2001:cccc::1
Protocol     : IKEv2 IPsec
Encryption   : IKEv2: (1)AES256  IPsec: (1)AES256
Hashing      : IKEv2: (1)SHA256  IPsec: (1)SHA1
Bytes Tx     : 352                    Bytes Rx     : 352
Login Time   : 12:27:36 UTC Sun Apr 12 2020
Duration     : 0h:06m:40s

IKEv2 Tunnels: 1
IPsec Tunnels: 1

IKEv2:
  Tunnel ID    : 473.1
  UDP Src Port : 500                    UDP Dst Port : 500
  Rem Auth Mode: preSharedKeys
  Loc Auth Mode: preSharedKeys
  Encryption   : AES256                 Hashing      : SHA256
  Rekey Int (T): 86400 Seconds          Rekey Left(T): 86000 Seconds
  PRF          : SHA256                 D/H Group    : 14
  Filter Name  :

IPsec:
  Tunnel ID    : 473.2
```

```
  Local Addr   : 2001:aaaa::/64/0/0
  Remote Addr  : 2001:dddd::/64/0/0
  Encryption   : AES256                Hashing      : SHA1
  Encapsulation: Tunnel
  Rekey Int (T): 28800 Seconds         Rekey Left(T): 28400 Seconds
  Rekey Int (D): 4608000 K-Bytes       Rekey Left(D): 4608000 K-Bytes
  Idle Time Out: 30 Minutes            Idle TO Left : 23 Minutes
  Bytes Tx     : 352                   Bytes Rx     : 352
  Pkts Tx      : 11                    Pkts Rx      : 11
```

# Troubleshoot

To troubleshoot IKEv2 tunnel establishment issues on ASA and FTD, run the following debug commands:

debug crypto condition peer <peer IP>
debug crypto ikev2 protocol 255
debug crypto ikev2 platform 255

Here is a sample working IKEv2 debugs for reference:
https://www.cisco.com/c/en/us/support/docs/security/asa-5500-x-series-next-generation-firewalls/115935-asa-ikev2-debugs.html

# References

https://www.cisco.com/c/en/us/support/docs/security-vpn/ipsec-negotiation-ike-protocols/119425-configure-ipsec-00.html
https://www.cisco.com/c/en/us/support/docs/security/asa-5500-x-series-next-generation-firewalls/81824-common-ipsec-trouble.html
https://www.cisco.com/c/en/us/td/docs/security/asa/asa95/configuration/vpn/asa-95-vpn-config/vpn-site2site.html