FGT 与 Strongswan 建立 IPSEC VPN

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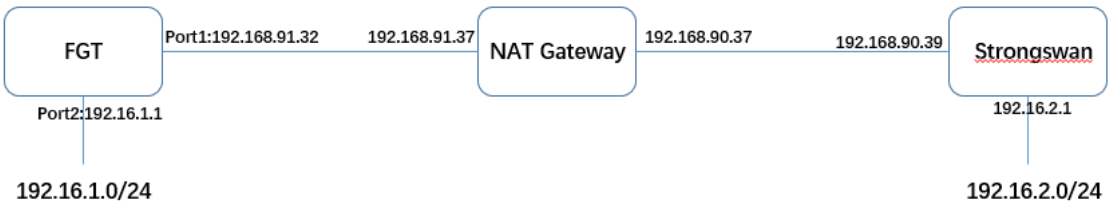
1. 网络拓扑



拓扑说明：

FGT 访问 Strongswan 时，NAT Gateway 做源 NAT；

NAT Gateway 同时映射了 FGT port1 接口 udp 500 和 4500 端口给 Strongswan；

2. 设备版本

FortiGate： v6.2.7

Strongswan：v5.7.2

3. 在 Centos7 上安装 Strongswan

安装 epel 源：yum install epel-release

安装 strongswan：yum install strongswan

安装完成查看 Strongswan 版本

```
[root@localhost ~]# strongswan version
Linux strongSwan U5.7.2/K3.10.0-957.el7.x86_64
University of Applied Sciences Rapperswil, Switzerland
See 'strongswan --copyright' for copyright information.
```

Strongswan 更新的版本可通过官网下载，然后源码安装

Strongswan 官网：https://www.strongswan.org/

Strongswan 参数参考：https://wiki.strongswan.org/projects/strongswan/wiki/Swanctlconf

4. Strongswan 配置

4.1. 特别说明

1. 上述截图出处：

   https://wiki.strongswan.org/projects/strongswan/wiki/UserDocumentation

2. 当使用 swanctl 和 starter 时，需要的配置文件是完全不同的；
3. 当使用 swanctl 时，启动的服务是 strongswan-swanctl；使用 starter 时，启动服务是 strongswan；
4. ipsec.conf 向 sdwanctl.conf 配置迁移：

   https://wiki.strongswan.org/projects/strongswan/wiki/Fromipsecconf

5. 本文后续配置均是基于 swanctl。

4.2. Strongswan 配置

Strongswan 配置参数：

https://wiki.strongswan.org/projects/strongswan/wiki/Swanctlconf

或者 man swanctl.conf

Strongswan 配置用例:

https://wiki.strongswan.org/projects/strongswan/wiki/UsableExamples

从 swanctl.conf 配置可以看从 strongswan 会读取当前 conf.d 目录下以.conf 结尾的配置文件

[root@localhost ~]# grep -Ev '#|^$' /etc/strongswan/swanctl/swanctl.conf

include conf.d/*.conf

新建配置文件：

vim /etc/strongswan/swanctl/conf.d/swanctl.conf

```
connections {
    #IPSEC 名称
     vpn1 {
       #IKE 版本，1 表示 IKEv1，2 表示 IKEv2
        version = 1
        #本地 IPSEC VPN 地址
        local_addrs = 192.168.90.39
        #对端 IPSEC VPN 地址
        remote_addrs = 192.168.90.37
        #IPSEC 阶段一加密集
        proposals = aes128-sha1-modp2048
        # 野蛮模式 yes，主动模式 no，默认是 no
        aggressive = yes
        #dpd 检测间隔
        dpd_delay = 5s
        #DPD 检测超时时间
        dpd_timeout = 15s
        #本地认证
        local{
            #认证方式：psk 预共享秘钥
            auth = psk
            #本地 id
```

```
            id = 192.168.90.39
        }
        #  对端认证
        remote{
            #对端 id
            id = 192.168.91.32
            auth = psk
        }
       #IPSEC 阶段二设置
        children {
            #阶段二名称，如果有多条感兴趣流，可以写多个，如 vpn2{xxx}
             vpn1 {
                #阶段二加密集
                esp_proposals = aes128-sha1-modp2048
                #本地感兴趣流
                local_ts = 192.16.2.0/24
                #对端感兴趣流
                remote_ts = 192.16.1.0/24
                #IPSEC 隧道模式
                mode = tunnel
                #  当 dpd 检测失败时会立即重新发起 IKE 协商
                dpd_action = restart
                #当加载配置时执行的动作
                start_action = trap
            }
        }
    }
}
#秘钥设置
secrets {
    # IKE preshared secret section for a specific secret.
    ike-vpn1 {
        #共享秘钥的值
        secret = "fortinet"
        #该共享秘钥属于谁，如果 id 为空或者 id = %any，表示匹配所有
        id = 192.168.91.32
    }
}
```

4. 3. 几个参数介绍

start_action：当加载配置时执行的动作

默认 none：被动模式，流量不能出发协商；

trap：流量可以触发协商，当对端主动断开后，流量依然可以出发协商；

start：当启动服务时主动发起协商，但当对端主动断开后，不会再发起协商，流量也不会触发协商；

手动发起 IPSEC 协商命令：swanctl --initiate --child <name>（阶段二的名称）

```
local{
                id = 192.168.90.39 #本地 ID
    }
remote{
                id = 192.168.91.32 #对端 ID
    }
secrets {

    ike-vpn1 {
            #该共享秘钥属于谁
            id = 192.168.91.32
        }
}
```

id 即 IPSEC 中的身份，默认是通过 IP 地址标识;

如果在有 NAT 的环境下，设备的 IP 地址是会转换，因此可以指定 id，如 id=192.168.91.32;

也可以使用 fqnd 类型，如 fqdn:test1；同样对端也要设置对应的类型和 id,若 id = %any 表示可以匹配所有。

ike-vpn1 是 secrets 中的一组秘钥，其中设置的 id 要合 remote 中的 id 对应，才能匹配的上；若 id 为空或者 id = %any，表示匹配所有。

4.4. Strongswan 日志

日志设置参考：

man strongswan.conf 中 LOGGER CONFIGURATION 章节；

vim /etc/strongswan/strongswan.conf

在 charon{}中添加设置文件日志，如果不配置，默认日志会输出到/var/log/messages

```
charon {
        #filelog 是关键字，定义类型日志
        filelog {
                #名称
                 charon {
                 #日志文件名称
                 path = /var/log/charon.log
                 #  日志时间格式
                 time_format = %b %e %T
                 #  日志中显示 ike 名称
                 ike_name = yes
                 #  是否覆盖日志文件
                 append = no
                 #  默认的日志级别
                 default = 1
                 #  刷新每一行到硬盘
                 flush_line = yes
                #  定义更高的子类日志级别，覆盖 default 对应子类的值
                 cfg = 4
                 ike = 2
                }
         }
}
```

日志级别：https://wiki.strongswan.org/projects/strongswan/wiki/LoggerConfiguration

Levels and Subsystems/Groups

The IKE daemon knows different numerical levels of logging, ranging from -1 to 4:

- -1: Absolutely silent
- 0: Very basic auditing logs, (e.g. SA up/SA down)
- 1: Generic control flow with errors, a good default to see whats going on
- 2: More detailed debugging control flow
- 3: Including RAW data dumps in hex
- 4: Also include sensitive material in dumps, e.g. keys

Each logging message also has a source from which subsystem in the daemon the log came from:

- app: applications other than daemons
- asn: Low-level encoding/decoding (ASN.1, X.509 etc.)
- cfg: Configuration management and plugins
- chd: CHILD_SA/IPsec SA
- dmn: Main daemon setup/cleanup/signal handling
- enc: Packet encoding/decoding encryption/decryption operations
- esp: libipsec library messages
- ike: IKE_SA/ISAKMP SA
- imc: Integrity Measurement Collector
- imv: Integrity Measurement Verifier
- job: Jobs queuing/processing and thread pool management
- knl: IPsec/Networking kernel interface
- lib: libstrongswan library messages
- mgr: IKE_SA manager, handling synchronization for IKE_SA access
- net: IKE network communication
- pts: Platform Trust Service
- tls: libtls library messages
- tnc: Trusted Network Connect

4.5. 系统配置

关闭防火墙

systemctl stop firewalld
systemctl disable firewalld

关闭 Selinux：

[root@localhost ~]# setenforce 0 #临时关闭
[root@localhost ~]# getenforce #查看 Selinux 状态
Permissive

永久关闭 Selinux：

vim /etc/selinux/config
[root@localhost ~]# grep dis /etc/selinux/config
# disabled - No SELinux policy is loaded.
SELINUX=disabled

如果不关闭 Selinux，Strongswan 启动将无法启动。

```
Apr 19 13:58:21 localhost setroubleshoot: SELinux is preventing /usr/sbin/swanctl from read access on the directory charon. For complete SELinux messages run:
sealert -l 7c9cb6d9-85e4-4079-887e-f1c2dfcce57e
Apr 19 13:58:21 localhost python: SELinux is preventing /usr/sbin/swanctl from read access on the directory charon.#012#012*****  Plugin catchall (100. confide
nce) suggests   **************************#012#012If you believe that swanctl should be allowed read access on the charon directory by default.#012Then you sho
uld report this as a bug.#012You can generate a local policy module to allow this access.#012Do#012allow this access for now by executing:#012# ausearch -c 'sw
```

转发相关

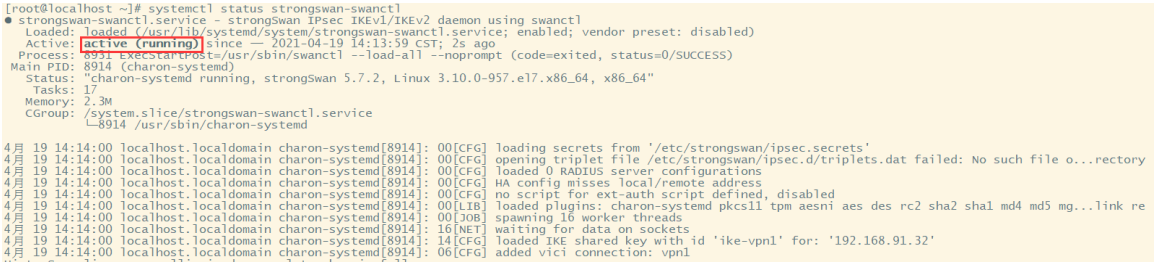
```
cat >> /etc/sysctl.conf << EOF
    ## 开启转发
    net.ipv4.ip_forward=1
    net.ipv6.conf.all.forwarding=1
     ## 禁止重定向，比如禁止 ICMP 重定向报文
    net.ipv4.conf.all.accept_redirects = 0
    net.ipv4.conf.all.send_redirects = 0
EOF
```

sysctl –p

4.6. 启动 Strongswan 服务

启动 strongswan 服务，并使其开机启动

[root@localhost ~]# systemctl start strongswan-swanctl
[root@localhost ~]# systemctl enable strongswan-swanctl



5. FGT 配置

配置 IPSEC

```
config vpn ipsec phase1-interface
    edit "to-strongswan"
        set interface "port1"
        set mode aggressive
        set peertype any
        set net-device disable
        set proposal aes128-sha1
        #如果 strongswan 指定了 id 和 id-类型，FGT 端也要明确指定
        set localid-type address
        set auto-negotiate disable
        set dpd on-idle
        set dpd-retrycount 3
        set dpd-retryinterval 5
        set dhgrp 14
        set remote-gw 192.168.90.39
        set psksecret fortinet
    next
end

config vpn ipsec phase2-interface
    edit "to-strongswan"
        set phase1name "to-strongswan"
        set proposal aes128-sha1
        set replay disable
        set src-subnet 192.16.1.0 255.255.255.0
        set dst-subnet 192.16.2.0 255.255.255.0
    next
end
```

配置策略

```
config firewall policy
    edit 1
        set name "test1"
        set srcintf "port2"
        set dstintf "to-strongswan"
        set srcaddr "all"
        set dstaddr "all"
        set action accept
```

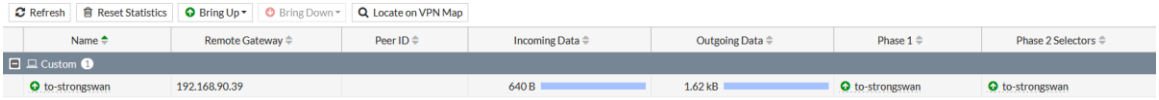
```
            set schedule "always"
            set service "ALL"
        next
        edit 2
            set name "test2"
            set srcintf "to-strongswan"
            set dstintf "port2"
            set srcaddr "all"
            set dstaddr "all"
            set action accept
            set schedule "always"
            set service "ALL"
        next
end
```

配置路由

```
config router static
        edit 1
            set dst 192.16.3.0 255.255.255.0
            set device "to-strongswan"
        next
end
```

6. 状态检查

FGT IPSEC 状态



Strongswan IPSEC 状态

```
[root@localhost ~]# swanctl --list-sas
vpn1: #2, ESTABLISHED, IKEv1, 51262afc0fac59e5_i 3d33cc26d81ed84c_r*
  local  '192.168.90.39' @ 192.168.90.39[4500]
  remote '192.168.91.32' @ 192.168.90.37[4500]
  AES_CBC-128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
  established 662s ago, rekeying in 12860s
  vpn1: #8, reqid 8, INSTALLED, TUNNEL-in-UDP, ESP:AES_CBC-128/HMAC_SHA1_96/MODP_2048
    installed 3s ago, rekeying in 3292s, expires in 3957s
    in  c6efc138,      0 bytes,     0 packets
    out 678fbdff,      0 bytes,     0 packets
    local  192.16.2.0/24
    remote 192.16.1.0/24
```

IKEv1 主模式/野蛮模式，IKEv2 测试都能正常建立连接。

但是，Strongswan 使用野蛮模式 PSK 认证提示不安全，默认不允许建立连接。

```
Apr 20 11:12:02 15[CFG] <1> selecting proposal:
Apr 20 11:12:02 15[CFG] <1>   proposal matches
Apr 20 11:12:02 15[CFG] <1> received proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 20 11:12:02 15[CFG] <1> configured proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 20 11:12:02 15[CFG] <1> selected proposal: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 20 11:12:02 15[IKE] <1> Aggressive Mode PSK disabled for security reasons
Apr 20 11:12:02 15[IKE] <1> queueing INFORMATIONAL task
Apr 20 11:12:02 15[IKE] <1> activating new tasks
Apr 20 11:12:02 15[IKE] <1>   activating INFORMATIONAL task
Apr 20 11:12:02 15[ENC] <1> generating INFORMATIONAL_V1 request 540149239 [ N(AUTH_FAILED) ]
Apr 20 11:12:02 15[NET] <1> sending packet: from 192.168.90.39[500] to 192.168.90.37[500] (56 bytes)
Apr 20 11:12:02 15[IKE] <1> IKE_SA (unnamed)[1] state change: CONNECTING => DESTROYING
Apr 20 11:12:05 07[NET] <2> received packet: from 192.168.90.37[500] to 192.168.90.39[500] (600 bytes)
```

需要在 vim /etc/strongswan/strongswan.conf 中添加如下选项：

i_dont_care_about_security_and_use_aggressive_mode_psk = yes

```
charon {
        load_modular = yes
        i_dont_care_about_security_and_use_aggressive_mode_psk = yes
        plugins {
                include strongswan.d/charon/*.conf
        }
```

7. Strongswan 日志查看

通过 tail -f /var/log/charon.log 观察 IPSEC 日志信息输出，来判断 IPSEC 的问题

①当发给 Strongswan 加密集不一致时，其日志信息

```
Apr 19 21:04:13 13[IKE] <1> 192.168.90.37 is initiating a Aggressive Mode IKE_SA
Apr 19 21:04:13 13[IKE] <1> IKE_SA (unnamed)[1] state change: CREATED => CONNECTING
Apr 19 21:04:13 13[CFG] <1> selecting proposal:
Apr 19 21:04:13 13[CFG] <1>   no acceptable INTEGRITY_ALGORITHM found
Apr 19 21:04:13 13[CFG] <1> received proposals: IKE:AES_CBC_128/HMAC_SHA2_256_128/PRF_HMAC_SHA2_256/MODP_2048
Apr 19 21:04:13 13[CFG] <1> configured proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 21:04:13 13[IKE] <1> no proposal found
Apr 19 21:04:13 13[IKE] <1> queueing INFORMATIONAL task
Apr 19 21:04:13 13[IKE] <1> activating new tasks
Apr 19 21:04:13 13[IKE] <1>   activating INFORMATIONAL task
Apr 19 21:04:13 13[ENC] <1> generating INFORMATIONAL_V1 request 3635494359 [ N(NO_PROP) ]
Apr 19 21:04:13 13[NET] <1> sending packet: from 192.168.90.39[500] to 192.168.90.37[500] (56 bytes)
Apr 19 21:04:13 13[IKE] <1> IKE_SA (unnamed)[1] state change: CONNECTING => DESTROYING
```

②当身份 id 不匹配时，其日志信息：

```
Apr 19 20:49:20 12[IKE] <1> 192.168.90.37 is initiating a Aggressive Mode IKE_SA
Apr 19 20:49:20 12[IKE] <1> IKE_SA (unnamed)[1] state change: CREATED => CONNECTING
Apr 19 20:49:20 12[CFG] <1> selecting proposal:
Apr 19 20:49:20 12[CFG] <1>   proposal matches
Apr 19 20:49:20 12[CFG] <1> received proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 20:49:20 12[CFG] <1> configured proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 20:49:20 12[CFG] <1> selected proposal: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 20:49:21 12[CFG] <1> looking for pre-shared key peer configs matching 192.168.90.39...192.168.90.37[192.168.91.32]
Apr 19 20:49:21 12[CFG] <1> peer config "vpn1", ike match: 3100 (192.168.90.39...192.168.90.37 IKEv1)
Apr 19 20:49:21 12[CFG] <1>   local id match: 1 (ID_ANY)
Apr 19 20:49:21 12[CFG] <1>   remote id match: 0 (ID_IPV4_ADDR: c0:a8:5b:20)
Apr 19 20:49:21 12[IKE] <1> no peer config found
Apr 19 20:49:21 12[IKE] <1> queueing INFORMATIONAL task
Apr 19 20:49:21 12[IKE] <1> activating new tasks
Apr 19 20:49:21 12[IKE] <1>   activating INFORMATIONAL task
```

③当共享秘钥不匹配时，其日志信息：

```
Apr 19 21:10:18 04[CFG] <vpn1|1> selecting proposal:
Apr 19 21:10:18 04[CFG] <vpn1|1>   proposal matches
Apr 19 21:10:18 04[CFG] <vpn1|1> received proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 21:10:18 04[CFG] <vpn1|1> configured proposals: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 21:10:18 04[CFG] <vpn1|1> selected proposal: IKE:AES_CBC_128/HMAC_SHA1_96/PRF_HMAC_SHA1/MODP_2048
Apr 19 21:10:18 04[IKE] <vpn1|1> calculated HASH does not match HASH payload
Apr 19 21:10:18 04[IKE] <vpn1|1> queueing INFORMATIONAL task
Apr 19 21:10:18 04[IKE] <vpn1|1> activating new tasks
Apr 19 21:10:18 04[IKE] <vpn1|1>   activating INFORMATIONAL task
Apr 19 21:10:18 04[ENC] <vpn1|1> generating INFORMATIONAL_V1 request 1922189643 [ HASH N(AUTH_FAILED) ]
Apr 19 21:10:18 04[NET] <vpn1|1> sending packet: from 192.168.90.39[500] to 192.168.90.37[500] (92 bytes)
Apr 19 21:10:18 04[IKE] <vpn1|1> IKE_SA vpn1[1] state change: CONNECTING => DESTROYING
Apr 19 21:10:18 06[CFG] vici client 2 disconnected
```

④当感兴趣流不匹配时，其日志信息：

```
Apr 20 11:29:26 03[NET] <vpn1|1> received packet: from 192.168.90.37[4500] to 192.168.90.39[4500] (364 bytes)
Apr 20 11:29:26 03[ENC] <vpn1|1> parsed QUICK_MODE request 3657100888 [ HASH SA No KE ID ID ]
Apr 20 11:29:26 03[CFG] <vpn1|1> looking for a child config for 192.16.2.0/24 === 192.16.3.0/24
Apr 20 11:29:26 03[CFG] <vpn1|1> proposing traffic selectors for us:
Apr 20 11:29:26 03[CFG] <vpn1|1>  192.16.2.0/24
Apr 20 11:29:26 03[CFG] <vpn1|1> proposing traffic selectors for other:
Apr 20 11:29:26 03[CFG] <vpn1|1>  192.16.1.0/24
Apr 20 11:29:26 03[IKE] <vpn1|1> no matching CHILD_SA config found for 192.16.3.0/24 === 192.16.2.0/24
Apr 20 11:29:26 03[IKE] <vpn1|1> queueing INFORMATIONAL task
Apr 20 11:29:26 03[IKE] <vpn1|1> activating new tasks
Apr 20 11:29:26 03[IKE] <vpn1|1>   activating INFORMATIONAL task
Apr 20 11:29:26 03[ENC] <vpn1|1> generating INFORMATIONAL_V1 request 1956105377 [ HASH N(INVAL_ID) ]
```