UNIVERSIDAD ANDINA DEL CUSCO

FACULTAD DE INGENIERÍA Y ARQUITECTURA

ESCUELA PROFESIONAL DE INGENIERÍA DE SISTEMAS

TEMA

"REDES PRIVADAS VIRTUALES (VPN) BASADAS EN IPSEC"

DOCENTE

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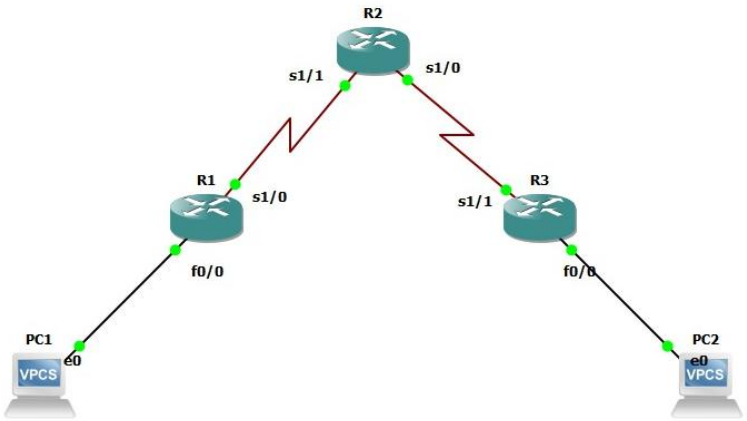
1. Diseño de la topologia de la red



2. Configuración de equipos terminales

A. Configuracion de PC1

```
PC1> ip 192.168.1.10/24 gateway 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.10 255.255.255.0 gateway 192.168.1.1
```

```
PC1> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=255 time=15.314 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=255 time=15.417 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=255 time=15.219 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=255 time=15.764 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=255 time=15.215 ms
```

B. Configuracion de PC2

```
PC2> ip 192.168.2.10/24 gateway 192.168.2.1
Checking for duplicate address...
PC1 : 192.168.2.10 255.255.255.0 gateway 192.168.2.1
```

```
PC2> ping 192.168.2.1
84 bytes from 192.168.2.1 icmp_seq=1 ttl=255 time=15.346 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=255 time=15.082 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=255 time=15.176 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=255 time=15.128 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=255 time=14.938 ms
```

3. Configuración de enrutadores

a) Configuración del enrutador R1

```
 changed state to down
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface serial 1/0
R1(config-if)#ip address 20.0.0.1 255.0.0.0
R1(config-if)#clock rate 64000
R1(config-if)#encapsulation ppp
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
*Mar  1 00:01:51.579: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 00:01:52.579: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R1(config)#
*Mar  1 00:01:53.223: %LINK-3-UPDOWN: Interface Serial1/0, changed state to up
R1(config)#
*Mar  1 00:02:10.431: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/0, changed state to up
```

b) Configuración del enrutador R2

```
R2#
R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#interface serial1/1
R2(config-if)#ip address 20.0.0.2 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#clock rate 64000
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface serial1/0
R2(config-if)#ip address 30.0.0.1 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#clock rate 64000
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#
*Mar  1 00:01:55.527: %LINK-3-UPDOWN: Interface Serial1/1, changed state to up
*Mar  1 00:01:55.963: %LINK-3-UPDOWN: Interface Serial1/0, changed state to up
```

c) Configuración del enrutador R3

PC1 | PC2 | R1 | R2 | R3

```
 changed state to down
R3#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#interface serial1/1
R3(config-if)#ip address 30.0.0.2 255.0.0.0
R3(config-if)#encapsulation ppp
R3(config-if)#clock rate 64000
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface fastethernet 0/0
R3(config-if)#ip address 192.168.2.1 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
*Mar  1 00:01:58.459: %LINK-3-UPDOWN: Interface Serial1/1, changed state to up
R3(config-if)#exit
R3(config)#
*Mar  1 00:01:59.495: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/1, changed state to up
R3(config)#
*Mar  1 00:02:00.263: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar  1 00:02:01.263: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

4. Configuración de la VPN

a) Configuración del enrutador R1

PC1 PC2 R1

```
*Mar  1 00:00:06.483: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et0/0, changed state to up
*Mar  1 00:00:06.855: %LINK-5-CHANGED: Interface Serial1/1, changed state to adm
inistratively down
*Mar  1 00:00:06.883: %LINK-5-CHANGED: Interface Serial1/2, changed state to adm
inistratively down
*Mar  1 00:00:06.887: %LINK-5-CHANGED: Interface Serial1/3, changed state to adm
inistratively down
*Mar  1 00:00:08.343: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/0,
 changed state to up
R1#
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#crypto isakmp enable
R1(config)#crypto isakmp policy 10
R1(config-isakmp)#authentication pre-share
R1(config-isakmp)#hash md5
R1(config-isakmp)#encryption des
R1(config-isakmp)#group 2
R1(config-isakmp)#lifetime 3600
R1(config-isakmp)#exit
R1(config)#crypto isakmp key security address 30.0.0.2 255.0.0.0
A pre-shared key for address mask 30.0.0.2 255.0.0.0 already exists!

R1(config)#crypto ipsec transform-set hoset esp-des esp-md5-hmac
R1(cfg-crypto-trans)#exit
R1(config)#$ 101 permit ip 192.168.1.0 0.0.0.255 192.168.2.0 0.0.0.255
R1(config)#crypto map r1map 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
        and a valid access list have been configured.
R1(config-crypto-map)#set peer 30.0.0.2
R1(config-crypto-map)#set transform-set hoset
R1(config-crypto-map)#match address 101
R1(config-crypto-map)#exit
R1(config)#interface Serial 1/0
R1(config-if)#crypto map r1map
R1(config-if)#exit
R1(config)#
```

b) Configuración del enrutador R3

```
R3(config)#crypto isakmp enable
R3(config)#crypto isakmp policy 10
R3(config-isakmp)#authentication pre-share
R3(config-isakmp)#hash md5
R3(config-isakmp)#encryption des
R3(config-isakmp)#group 2
R3(config-isakmp)#lifetime 3600
R3(config-isakmp)#exit
R3(config)#crypto isakmp key security address 20.0.0.1 255.0.0.0
R3(config)#crypto ipsec transform-set r3set esp-des esp-md5-hmac
R3(cfg-crypto-trans)#exit
R3(config)#$ 101 permit ip 192.168.2.0 0.0.0.255 192.168.1.0 0.0.0.255
R3(config)#crypto map r3map 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
        and a valid access list have been configured.
R3(config-crypto-map)#set peer 20.0.0.1
R3(config-crypto-map)#set transform-set r3set
R3(config-crypto-map)#match address 101
R3(config-crypto-map)#exit
R3(config)#interface serial 1/1
R3(config-if)#crypto map r3map
R3(config-if)#exit
*Mar  1 00:02:50.179: %CRYPTO-6-ISAKMP ON OFF: ISAKMP is ON
```

5. Configuración del enrutamiento

a) **Cofiguración del router R1**

```
R1(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.2
```

b) **Cofiguración del router R**

```
R3(config)#ip route 0.0.0.0 0.0.0.0 30.0.0.1
```

6. Habilitar la depuracion para IPSEC e ISAKMP

a) **Configuración del enrutador R1**

```
R1#debug crypto ipsec
Crypto IPSEC debugging is on
R1#debug crypto isakmp
Crypto ISAKMP debugging is on
R1#
*Mar  1 00:04:32.143: IPSEC(sa_request): ,
  (key eng. msg.) OUTBOUND local= 20.0.0.1, remote= 30.0.0.2,
```

b) **Configuración del enrutador R3**

```
R3#debug crypto ipsec
Crypto IPSEC debugging is on
R3#debug crypto isakmp
*Mar  1 00:03:48.171: %SYS-5-CONFIG_I: Configured from console by console
R3#debug crypto isakmp
Crypto ISAKMP debugging is on
R3#
```

7. Pruebas de conectividad

a) **Prueba desde PC1**

```
PC1> ping 192.168.2.10
192.168.2.10 icmp_seq=1 timeout
192.168.2.10 icmp_seq=2 timeout
84 bytes from 192.168.2.10 icmp_seq=3 ttl=62 time=90.463 ms
84 bytes from 192.168.2.10 icmp_seq=4 ttl=62 time=90.954 ms

84 bytes from 192.168.2.10 icmp_seq=5 ttl=62 time=91.355 ms
```

c) **Prueba desde PC2**

```
PC2> ping 192.168.1.10
192.168.1.10 icmp_seq=1 timeout
192.168.1.10 icmp_seq=2 timeout
84 bytes from 192.168.1.10 icmp_seq=3 ttl=62 time=91.852 ms
84 bytes from 192.168.1.10 icmp_seq=4 ttl=62 time=90.262 ms
84 bytes from 192.168.1.10 icmp_seq=5 ttl=62 time=90.860 ms
```

8. Diagnostico VPN

a) En el enrutador R1

```
R1#
R1#show crypto isakmp policy

Global IKE policy
Protection suite of priority 10
        encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
        hash algorithm:         Message Digest 5
        authentication method:  Pre-Shared Key
        Diffie-Hellman group:   #2 (1024 bit)
        lifetime:               3600 seconds, no volume limit
Default protection suite
        encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
        hash algorithm:         Secure Hash Standard
        authentication method:  Rivest-Shamir-Adleman Signature
        Diffie-Hellman group:   #1 (768 bit)
        lifetime:               86400 seconds, no volume limit
R1#
```

b) En el enrutador R2

```
R3#
R3#show crypto isakmp policy

Global IKE policy
Protection suite of priority 10
        encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
        hash algorithm:         Message Digest 5
        authentication method:  Pre-Shared Key
        Diffie-Hellman group:   #2 (1024 bit)
        lifetime:               3600 seconds, no volume limit
Default protection suite
        encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
        hash algorithm:         Secure Hash Standard
        authentication method:  Rivest-Shamir-Adleman Signature
        Diffie-Hellman group:   #1 (768 bit)
        lifetime:               86400 seconds, no volume limit
R3#
```