UNIVERSIDAD ANDINA DEL CUSCO

FACULTAD DE INGENIERÍA Y ARQUITECTURA

ESCUELA PROFESIONAL DE INGENIERÍA DE SISTEMAS

TEMA:

REDES PRIVADAS VIRTUALES (VPN) BASADAS EN IPSEC

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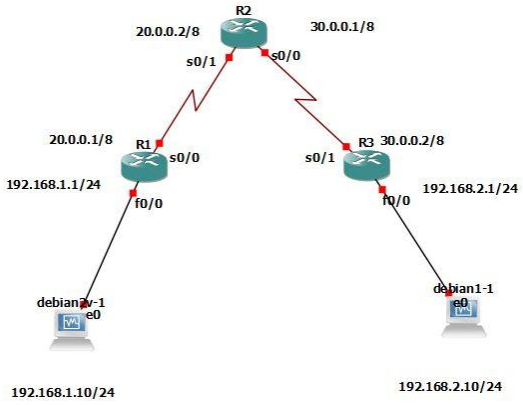
1. DISEÑO DE LA TOPOLOGIA DE LA RED



2. CONFIGURACIÓN DE EQUIPOS TERMINALES

a) 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=47.365 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=255 time=16.059 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=255 time=14.969 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=255 time=20.202 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=255 time=15.052 ms

PC1>
```

b) 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=15.702 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=255 time=16.282 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=255 time=14.966 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=255 time=15.514 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=255 time=15.333 ms

PC2>
```

3. CONFIGURACION DE LOS ENRUTADORES

a) CONFIGURACIÓN DEL ENRUTADOR R1

```
R1#enable
R1#config te
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#interface fas
R1(config)#interface fastEthernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
*Mar  1 00:21:28.975: %LINK-3-UPDOWN: Interface FastEthernet0/0,
*Mar  1 00:21:29.975: %LINEPROTO-5-UPDOWN: Line protocol on Inter
R1(config)#interface serial 0/0
R1(config-if)#ip address 20.0.0.1 255.0.0.0
R1(config-if)#clock rate 64000
R1(config-if)#en
R1(config-if)#encapsulation ppp
R1(config-if)#no sh
R1(config-if)#exit
```

b) CONFIGURACIÓN DEL ENRUTADOR R2

```
R2#enable
R2#conf
R2#configure t
R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#in
R2(config)#interface serial 0/1
R2(config-if)#ip address 20.0.0.2 255.0.0.0
R2(config-if)#en
R2(config-if)#encapsulation ppp
R2(config-if)#clock rate 64000
R2(config-if)#no sh
R2(config-if)#exit
*Mar  1 00:13:59.463: %LINK-3-UPDOWN: Interface Serial0/1, changed state to up
R2(config-if)#exit
*Mar  1 00:14:00.547: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1,
R2(config-if)#exit
R2(config)#inter
R2(config)#interface serial 0/0
R2(config-if)#ip address 30.0.0.1 255.0.0.0
R2(config-if)#en
R2(config-if)#encapsulation ppp
R2(config-if)#clock rate 64000
R2(config-if)#no sh
R2(config-if)#exit
```

c) CONFIGURACIÓN DEL ENRUTADOR R3

```
R3#conf terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#interface serial 0/1
R3(config-if)#ip address 30.0.0.2 255.0.0.0
R3(config-if)#en
R3(config-if)#encapsulation ppp
R3(config-if)#clock rate 64000
R3(config-if)#no sh
R3(config-if)#exit
R3(config)#
*Mar  1 00:15:26.915: %LINK-3-UPDOWN: Interface Serial0/1, ch
R3(config)#
*Mar  1 00:15:27.971: %LINEPROTO-5-UPDOWN: Line protocol on I
R3(config)#inte
R3(config)#interface fas
R3(config)#interface fastEthernet 0/0
R3(config-if)#ip address 192.168.2.1 255.255.255.0
R3(config-if)#no sh
R3(config-if)#exit
```

4. CONFIGURACION DE LA VPN
   a) CONFIGURACIÓN DEL ENRUTADOR R1

```
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#crypto is
R1(config)#crypto isakmp en
R1(config)#crypto isakmp enable
R1(config)#cr
R1(config)#cry
R1(config)#crypto isa
R1(config)#crypto isakmp policy 10
R1(config-isakmp)#aut
R1(config-isakmp)#authentication pre
R1(config-isakmp)#authentication pre-share
R1(config-isakmp)#has
R1(config-isakmp)#hash md5
R1(config-isakmp)#en
R1(config-isakmp)#encryption des
R1(config-isakmp)#group 2
R1(config-isakmp)#lifetime 3600
R1(config-isakmp)#exit
R1(config)#cr
R1(config)#cry
R1(config)#crypto isakmp key security address 30.0.0.2 255.0.0.0
R1(config)#crypto ipsec transform-set hoset esp-des esp-md5-hmac
R1(cfg-crypto-trans)#exit
R1(config)#acc
R1(config)#access-list 101 per
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 tr
R1(config-crypto-map)#set transform-set hoset
R1(config-crypto-map)#match address 101
R1(config-crypto-map)#exit
R1(config)#inter
R1(config)#interface ser
R1(config)#interface serial 0/0
R1(config-if)#cry
R1(config-if)#crypto map r1map
R1(config-if)#exit
*Mar  1 00:36:00.743: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
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)#au
R3(config-isakmp)#authentication pr
R3(config-isakmp)#authentication pre-share
R3(config-isakmp)#hash md5
R3(config-isakmp)#en
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 trans
R3(config)#crypto ipsec transform-set r3set esp-des esp-md5-hmac
R3(cfg-crypto-trans)#exit
R3(config)#ace
R3(config)#acc
R3(config)#$ 101 permit ip 192.168.2.0 0.0.0.255 192.168.1.0 0.0.0.255
R3(config)#cry
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 tras
R3(config-crypto-map)#set trasn
R3(config-crypto-map)#set trans
R3(config-crypto-map)#set transform-set r3set
R3(config-crypto-map)#match address 101
R3(config-crypto-map)#exit
R3(config)#interface serial 0/1
R3(config-if)#crypto map r3map
```

5. CONFIGURACION DEL ENRUTAMIENTO
   a) CONFIGURACIÓN DEL ENRUTADOR R1

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

   b) CONFIGURACIÓN DEL ENRUTADOR R3

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

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#
```

b) CONFIGURACIÓN DEL ENRUTADOR R3