

IMPLEMENTACIÓN DEL PROTOCOLO SS7 SOBRE CONEXIONES ENTRE DOS SERVIDORES ASTERISK UTILIZANDO LOS EQUIPOS SDH DEL LABORATORIO DE TELECOMUNICACIONES

Expositores:

Alejandro Azú Campoverde
Rafael Jiménez Ferrerosa



ANTECEDENTES

- ◆ Los antecedentes de este proyecto son:

Necesidades en la comunicación

Asterisk como ayudante indispensable

Importancia de la señalización

Utilización de SS7

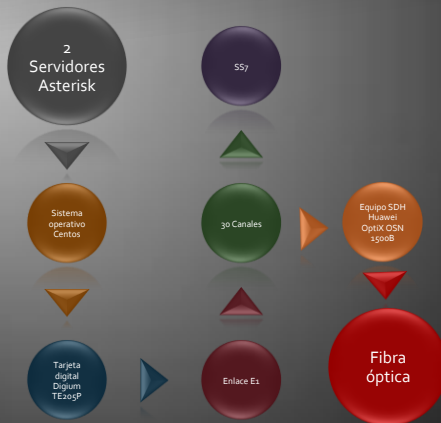


OBJETIVOS

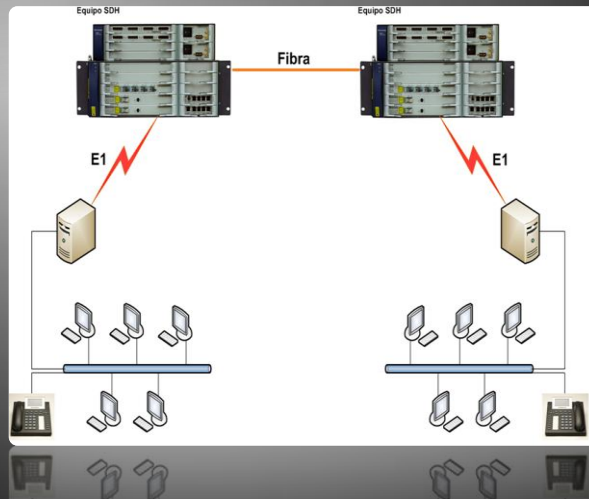


DESCRIPCIÓN

Funcionamiento del proyecto

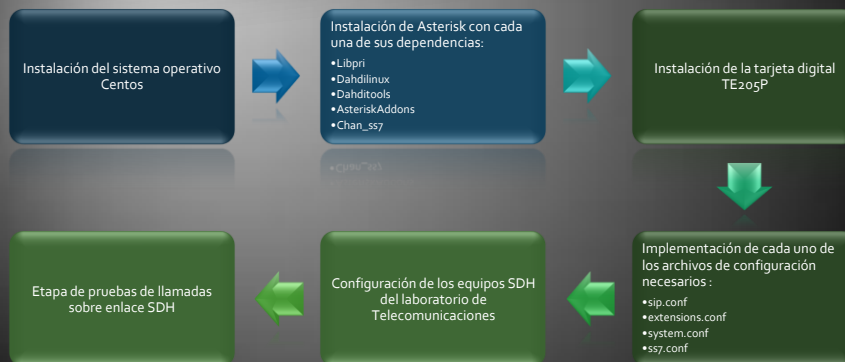


ESQUEMA



METODOLOGÍA

Procedimiento de implementación del proyecto

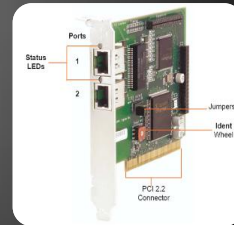


COMPONENTES

- Especificaciones técnicas del hardware utilizado:

Especificaciones de hardware del servidor

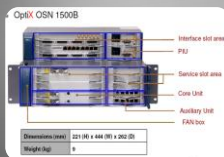
Componente	Características
Procesador	Intel Pentium 4 de 2.6 GHZ
Ram	1 GB
Tarjeta de Red	10/100 Mbps
Disco Duro	80 GB
Tarjeta digital	Marca Digium TE205P 2 puertos



Tarjeta Digium TE205P

COMPONENTES

- Especificaciones técnicas del hardware utilizado:



OptiX OSN 1500B

Equipo SDH

Marca

HUAWEI

Modelo

OptiX OSN 1500B

Teléfono VoIP

Marca

GRANDSTREAM

Modelo

GXP2000



Grandstream GPX2000

COMPONENTES

- Especificaciones técnicas del software utilizado:



Especificaciones de software del servidor

Componente	Características
Sistema Operativo	Linux
Distribución	Centos 5.2
Arquitectura	x86
Software IP PBX	Asterisk 1.4

CONFIGURACIÓN DE ASTERISK:

- Archivos de configuración empleados para la implementación del proyecto:



SIP.CONF

- Sirve para la configuración del protocolo, proveedores y usuarios sip.

```
[general]
```

```
context=default
srlookup=yes
language=es
```

```
[1001]
```

```
type=friend
secret=1001
qualify=yes
nat=no
host=dynamic
canreinvite=no
context=internal
```

```
context=internal
srlookup=no
language=es
```

/etc/asterisk/sip.conf

```
[general]
```

```
context = default
srlookup = yes
language = es
```

```
[2001]
```

```
type = friend
secret = 2001
qualify = yes
nat = no
host = dynamic
canreinvite = no
context = internal
```

```
[2002]
```

```
type = friend
secret = 2002
qualify = yes
nat = no
host = dynamic
canreinvite = no
context = internal
```

```
context=internal
```

EXTENSIONS.CONF

- Es el plan de marcado que ejecuta Asterisk.

```
[general]
```

```
[internal]
exten => 1001,1,Dial(SIP/1001,10,r)
exten => 1002,1,Dial(SIP/1002,10,r)
```

```
exten => 1003,1,Answer()
exten => 1003,2,Wait(90)
exten => 1003,3,Hangup()
```

```
exten => 1004,1,Answer()
exten => 1004,2,Wait(90)
exten => 1004,3,Hangup()
```

```
exten => 1005,1,Answer()
exten => 1005,2,Wait(90)
exten => 1005,3,Hangup()
```

```
exten => 1006,1,Answer()
exten => 1006,2,Wait(90)
exten => 1006,3,Hangup()
```

```
exten => 1007,1,Answer()
exten => 1007,2,Wait(90)
exten => 1007,3,Hangup()
```

```
exten => 1008,1,Answer()
exten => 1008,2,Wait(90)
exten => 1008,3,Hangup()
```

```
exten => 1009,1,Answer()
exten => 1009,2,Wait(90)
exten => 1009,3,Hangup()
```

```
exten => 1010,1,Answer()
exten => 1010,2,Wait(90)
exten => 1010,3,Hangup()
```

```
exten => 1011,1,Answer()
exten => 1011,2,Wait(90)
exten => 1011,3,Hangup()
```

```
exten => 1012,1,Answer()
exten => 1012,2,Wait(90)
exten => 1012,3,Hangup()
```

```
exten => 1013,1,Answer()
exten => 1013,2,Wait(90)
exten => 1013,3,Hangup()
```

```
exten => 1014,1,Answer()
exten => 1014,2,Wait(90)
exten => 1014,3,Hangup()
```

```
exten => 1015,1,Answer()
exten => 1015,2,Wait(90)
exten => 1015,3,Hangup()
```

```
exten => 1016,1,Answer()
exten => 1016,2,Wait(90)
exten => 1016,3,Hangup()
```

```
exten => 1017,1,Answer()
exten => 1017,2,Wait(90)
exten => 1017,3,Hangup()
```

```
exten => 1018,1,Answer()
exten => 1018,2,Wait(90)
exten => 1018,3,Hangup()
```

```
exten => 1019,1,Answer()
exten => 1019,2,Wait(90)
exten => 1019,3,Hangup()
```

```
exten => 1020,1,Answer()
exten => 1020,2,Wait(90)
exten => 1020,3,Hangup()
```

```
exten => 1021,1,Answer()
exten => 1021,2,Wait(90)
exten => 1021,3,Hangup()
```

```
exten => 1022,1,Answer()
exten => 1022,2,Wait(90)
exten => 1022,3,Hangup()
```

```
exten => 1023,1,Answer()
exten => 1023,2,Wait(90)
exten => 1023,3,Hangup()
```

```
exten => 1024,1,Answer()
exten => 1024,2,Wait(90)
exten => 1024,3,Hangup()
```

```
exten => 1025,1,Answer()
exten => 1025,2,Wait(90)
exten => 1025,3,Hangup()
```

```
exten => 1026,1,Answer()
exten => 1026,2,Wait(90)
exten => 1026,3,Hangup()
```

```
exten => 1027,1,Answer()
exten => 1027,2,Wait(90)
exten => 1027,3,Hangup()
```

```
exten => 1028,1,Answer()
exten => 1028,2,Wait(90)
exten => 1028,3,Hangup()
```

```
exten => 1029,1,Answer()
exten => 1029,2,Wait(90)
exten => 1029,3,Hangup()
```

```
exten => 1030,1,Answer()
exten => 1030,2,Wait(90)
exten => 1030,3,Hangup()
```

```
exten => 1031,1,Answer()
exten => 1031,2,Wait(90)
exten => 1031,3,Hangup()
```

```
exten => 1032,1,Answer()
exten => 1032,2,Wait(90)
exten => 1032,3,Hangup()
```

```
exten => 1033,1,Answer()
exten => 1033,2,Wait(90)
exten => 1033,3,Hangup()
```

```
exten => _XXXX,1,Dial(SSTX/${EXTEN},10,r)
exten => _XXXX,2,Wait(90)
exten => _XXXX,3,Hangup()
```

```
[internal]
```

```
exten => 2001,1,Dial(SIP/2001,10,r)
exten => 2002,1,Dial(SIP/2002,10,r)
```

```
exten => _1XXX,1,Dial(SS7/${EXTEN},10,r)
exten => 123,1,System(/etc/asterisk/script)
```

```
[ss7]
```

```
include => internal
```

```
[internal]
```

```
[ss7]
```

/etc/asterisk/extensions.conf

```
[internal]
```

```
[ss7]
```

```
include => internal
```

SS7.CONF

- Sirve para configuración de hardware a alto nivel.

```
[linkset-siuc]
enabled => yes
enable_st => no
use_connect => yes
hunting_policy => even_mru
context => ss7
language => es
subservice => auto
```

```
[[link-l1]
linkset => siuc
channels => 1-15,17-31
schannel => 16
firstcic => 1
enabled => yes
```

/etc/asterisk/ss7.conf

```
enable_st => no
firstcic => 1
```

```
[[link-l2]
linkset => siuc
channels => 1-15,17-31
schannel => 16
firstcic => 1
enabled => yes
```

```
[host-wrks129-213fie]
enabled => yes
opc => ox1
dpc => siuc:ox2
links => l1:1
```

```
[host-wrks129-214fie]
enabled => yes
opc => ox2
dpc => siuc:ox1
links => l2:1
```

```
[[opc2 => |3:3
qbc => 2inc:ox3
obc => ox3
enable_st => no
[[host-wrks129-213fie]
```

SYSTEM.CONF

- Sirve para configuración de hardware a bajo nivel.

```
span=1,0,0,ccs,hdb3
bchan=1-31
```

```
span=1,1,0,ccs,hdb3
bchan=1-31
```

/etc/dahdi/system.conf

CONFIGURACIÓN DE EQUIPOS SDH:

- Topología anillo del laboratorio de Telecomunicaciones

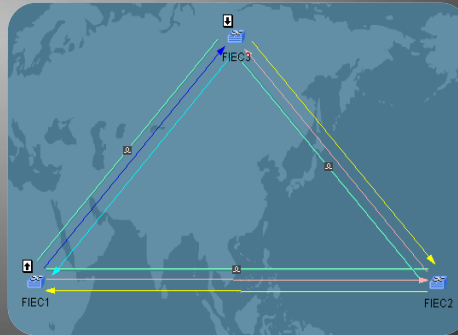
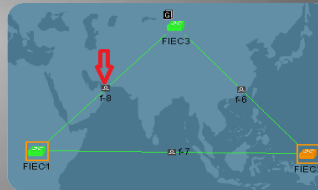


Imagen otorgada por el T2000

CREACIÓN DE SERVICIO:

- Selección del enlace sobre el cual se va a trabajar



- Servicios que ya han sido creados

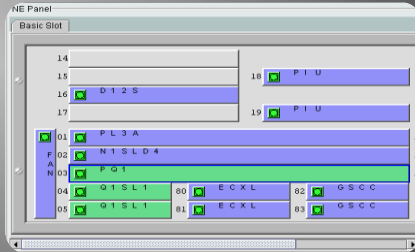
Status	Alarm Status	Name	Source	Source Timeslot	Sink	Sink Timeslot	ID	Cre
Non-Alarmed		FIEC1-FIEC2-VC12-0001	FIEC1-13-P01-1(SDH_TU-1)		FIEC2-13-P01-4(SDH_TU-4)		0	2010-01-

Total: 1 Selected: 1 Relevant View Filter Create ▼ Alarm ▼ Performance ▼ Maintenance ▼ Report ▼ Print Save As

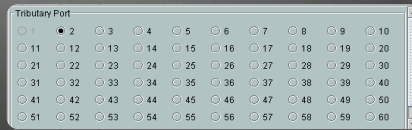
(Query Relevant Trails)

CREACIÓN DE SERVICIO:

- Tarjetas que posee el equipo SHD

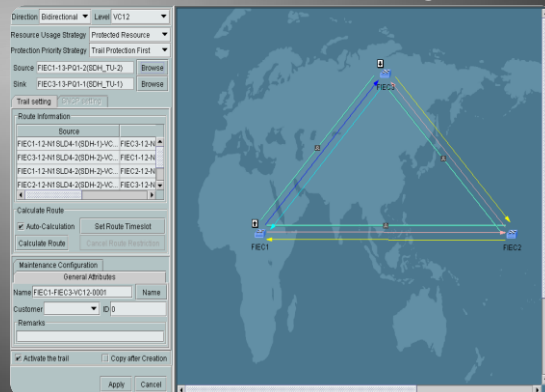


- Puertos que posee la tarjeta PQ1



CREACIÓN DE SERVICIO:

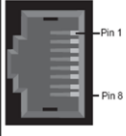
- Nuevo servicio creado entre FIEC₁ Y FIEC₃



Fuente : FIEC1-13-PQ1-2(SDH_TU-2)
Destino : FIEC3-13-PQ1-1(SDH_TU-1)

PRUEBAS DEL PROYECTO

- Pruebas con Hardware

	Pin	Description
	1	Rx
	2	Rx
	3	Not used
	4	Tx
	5	Tx
	6	Not used
	7	Not used
	8	Not used

Pines utilizados por el cable E1 crossover



Led encendido en la tarjeta TE205P

PRUEBAS DEL PROYECTO

- Inicializando con Asterisk

Así mismo se debe de revisar en la consola del terminal el correcto funcionamiento de la tarjeta con los siguientes comandos:

- ▶ *dahdi_cfg*
- ▶ *service dahdi restart*

```

root@wrks19-228f1ec:~
Archivo Editar Ver Terminal Solapas Ayuda
root@wrks19-228f1ec:~ x root@wrks19-228f1ec:~/Desktop/x... x root@wrks19-228f1ec:~
[root@wrks19-228f1ec ~]# dahdi_cfg
[root@wrks19-228f1ec ~]# dahdi_cfg
[root@wrks19-228f1ec ~]# dahdi_cfg
[root@wrks19-228f1ec ~]# service dahdi restart
Unloading DAHDI hardware modules: ERROR: Module wct4xxp is in use
ERROR: Module dahdi is in use by wct4xxp
error
Loading DAHDI hardware modules:
wct4xxp: [ OK ]
Running dahdi_cfg: [ OK ]
[root@wrks19-228f1ec ~]#

```

PRUEBAS DEL PROYECTO

- Verificación de canales habilitados con el comando *ss7 show channels*

```
wrks19-228f1ec*CLI> ss7 show channels
Linkset: siucc*CLI>
CIC 1 Idle
CIC 2 Idle
CIC 3 Idle
CIC 4 Idle
CIC 5 Idle
CIC 6 Idle
CIC 7 Idle
CIC 8 Idle
CIC 9 Idle
CIC 10 Idle
CIC 11 Idle
CIC 12 Idle
CIC 13 Idle
CIC 14 Idle
CIC 15 Idle
CIC 17 Idle
CIC 18 Idle
CIC 19 Idle
CIC 20 Idle
CIC 21 Idle
CIC 22 Idle
CIC 23 Idle
CIC 24 Idle
CIC 25 Idle
CIC 26 Idle
CIC 27 Idle
CIC 28 Idle
CIC 29 Idle
CIC 30 Idle
CIC 31 Idle
wrks19-228f1ec*CLI> █
```

PRUEBAS DEL PROYECTO

- Comprobar la comunicación entre los servidores utilizando el comando:

originate SS7/1001 application echo

```
wrks19-228f1ec*CLI>
-- Recv IAM CIC=30 ANI=2001 DNI=1001 RNI= redirect=no/0 complete=1
-- Executing [1001@ss7:1] Dial("SS7/siuc/30", "SIP/1001|10|r") in new stack
-- Called 1001
-- SIP/1001-0845b338 is ringing
-- SIP/1001-0845b338 answered SS7/siuc/30
wrks19-228f1ec*CLI> █
```

ETAPA DE PRUEBAS CON EL EQUIPO SDH

- Verificar que están habilitados FIEC1 en el puerto 1 y FIEC2 en el puerto 4

Alarm Status	Name	Source	Source Timeslot	Sink
Non-Alarmed	FIEC1-FIEC2-VC12-0001	FIEC1-13-PQ1-1(SDH_TU-1)		FIEC2-13-PQ1-4(SDH_TU-4)

- Conexión de los servidores con los equipos SDH



ETAPA DE PRUEBAS CON EL EQUIPO SDH

- Script para generar 30 llamadas simultaneas

```
#!/bin/sh
a=1033

for ((i=1;i<32;i+=1));do
#echo "entra" $a
asterisk -rx "originate SS7/$a
application echo"
a=`expr $a - 1`
#echo $a
done
```

/etc/asterisk/script

- Ejecución del script desde el servidor B

```
-- Executing [123@internal:1] System("SIP/2001-00000012", "/etc/asterisk/script") in new stack
```

ETAPA DE PRUEBAS CON EL EQUIPO SDH

- Pantalla del servidor A, recibiendo llamadas desde el servidor B

```
Archivo Editar Ver Terminal Solapas Ayuda
-- Recv IAM CIC-29 ANI-DNI-1033 RNI- redirect-no/0 complet=1
-- Executing (1833867:1) Answer('557/siuc/30', '') in new stack
-- Recv IAM CIC-28 ANI-DNI-1032 RNI- redirect-no/0 complet=1
-- Executing (18332867:1) Answer('557/siuc/28', '') in new stack
-- Executing (18320867:2) Wait('557/siuc/28', '90') in new stack
-- Recv IAM CIC-26 ANI-DNI-1031 RNI- redirect-no/0 complet=1
-- Executing (1831867:1) Answer('557/siuc/26', '') in new stack
-- Executing (1831867:2) Wait('557/siuc/26', '90') in new stack
-- Recv IAM CIC-24 ANI-DNI-1030 RNI- redirect-no/0 complet=1
-- Executing (1829867:1) Answer('557/siuc/24', '') in new stack
-- Executing (1829867:2) Wait('557/siuc/24', '90') in new stack
-- Recv IAM CIC-22 ANI-DNI-1029 RNI- redirect-no/0 complet=1
-- Executing (1829067:1) Answer('557/siuc/22', '') in new stack
-- Executing (1829067:2) Wait('557/siuc/22', '90') in new stack
-- Recv IAM CIC-20 ANI-DNI-1028 RNI- redirect-no/0 complet=1
-- Executing (1828867:1) Answer('557/siuc/20', '') in new stack
-- Executing (1828867:2) Wait('557/siuc/20', '90') in new stack
-- Recv IAM CIC-18 ANI-DNI-1027 RNI- redirect-no/0 complet=1
-- Executing (1827867:1) Answer('557/siuc/18', '') in new stack
-- Executing (1827867:2) Wait('557/siuc/18', '90') in new stack
-- Recv IAM CIC-16 ANI-DNI-1026 RNI- redirect-no/0 complet=1
-- Executing (1826867:1) Answer('557/siuc/16', '') in new stack
-- Executing (1826867:2) Wait('557/siuc/16', '90') in new stack
-- Recv IAM CIC-14 ANI-DNI-1025 RNI- redirect-no/0 complet=1
-- Executing (1825867:1) Answer('557/siuc/14', '') in new stack
-- Executing (1825867:2) Wait('557/siuc/14', '90') in new stack
-- Recv IAM CIC-12 ANI-DNI-1024 RNI- redirect-no/0 complet=1
-- Executing (1824867:1) Answer('557/siuc/12', '') in new stack
-- Executing (1824867:2) Wait('557/siuc/12', '90') in new stack
-- Recv IAM CIC-10 ANI-DNI-1023 RNI- redirect-no/0 complet=1
-- Executing (1823867:1) Answer('557/siuc/10', '') in new stack
-- Executing (1823867:2) Wait('557/siuc/10', '90') in new stack
-- Recv IAM CIC-8 ANI-DNI-1022 RNI- redirect-no/0 complet=1
-- Executing (1822867:1) Answer('557/siuc/8', '') in new stack
-- Executing (1822867:2) Wait('557/siuc/8', '90') in new stack
-- Recv IAM CIC-6 ANI-DNI-1021 RNI- redirect-no/0 complet=1
-- Executing (1821867:1) Answer('557/siuc/6', '') in new stack
-- Executing (1821867:2) Wait('557/siuc/6', '90') in new stack
-- Recv IAM CIC-4 ANI-DNI-1020 RNI- redirect-no/0 complet=1
-- Executing (1820867:1) Answer('557/siuc/4', '') in new stack
-- Executing (1820867:2) Wait('557/siuc/4', '90') in new stack
-- Recv IAM CIC-2 ANI-DNI-1019 RNI- redirect-no/0 complet=1
-- Executing (1819867:1) Answer('557/siuc/2', '') in new stack
-- Executing (1819867:2) Wait('557/siuc/2', '90') in new stack
-- Recv IAM CIC-0 ANI-DNI-1018 RNI- redirect-no/0 complet=1
```

ETAPA DE PRUEBAS CON EL EQUIPO SDH

- Cierre de la llamadas pasado los 90 segundos, en el Servidor A

```
Archivo Editar Ver Terminal Solapas Ayuda
-- Executing (1833867:3) Hangup('557/siuc/30', '') in new stack
-- Spam extension (557, 1033, 3) exited non-zero on '557/siuc/30'
-- 557 hangup: '557/siuc/30' CIC=0 Cause=16 (state=5)
-- Executing (18320867:3) Hangup('557/siuc/28', '') in new stack
-- Spam extension (557, 1032, 3) exited non-zero on '557/siuc/28'
-- 557 hangup: '557/siuc/28' CIC=28 Cause=16 (state=5)
-- Executing (1831867:3) Hangup('557/siuc/26', '') in new stack
-- Spam extension (557, 1031, 3) exited non-zero on '557/siuc/26'
-- 557 hangup: '557/siuc/26' CIC=26 Cause=16 (state=5)
-- Executing (1829867:3) Hangup('557/siuc/24', '') in new stack
-- Spam extension (557, 1029, 3) exited non-zero on '557/siuc/24'
-- 557 hangup: '557/siuc/24' CIC=24 Cause=16 (state=5)
-- Executing (1829067:3) Hangup('557/siuc/22', '') in new stack
-- Spam extension (557, 1029, 3) exited non-zero on '557/siuc/22'
-- 557 hangup: '557/siuc/22' CIC=22 Cause=16 (state=5)
-- Executing (1828867:3) Hangup('557/siuc/20', '') in new stack
-- Spam extension (557, 1028, 3) exited non-zero on '557/siuc/20'
-- 557 hangup: '557/siuc/20' CIC=20 Cause=16 (state=5)
-- Executing (1827867:3) Hangup('557/siuc/18', '') in new stack
-- Spam extension (557, 1027, 3) exited non-zero on '557/siuc/18'
-- 557 hangup: '557/siuc/18' CIC=18 Cause=16 (state=5)
-- Executing (1827067:3) Hangup('557/siuc/16', '') in new stack
-- Spam extension (557, 1027, 3) exited non-zero on '557/siuc/16'
-- 557 hangup: '557/siuc/16' CIC=16 Cause=16 (state=5)
-- Executing (1826867:3) Hangup('557/siuc/14', '') in new stack
-- Spam extension (557, 1026, 3) exited non-zero on '557/siuc/14'
-- 557 hangup: '557/siuc/14' CIC=14 Cause=16 (state=5)
-- Executing (1825867:3) Hangup('557/siuc/12', '') in new stack
-- Spam extension (557, 1025, 3) exited non-zero on '557/siuc/12'
-- 557 hangup: '557/siuc/12' CIC=12 Cause=16 (state=5)
-- Executing (1824867:3) Hangup('557/siuc/10', '') in new stack
-- Spam extension (557, 1024, 3) exited non-zero on '557/siuc/10'
-- 557 hangup: '557/siuc/10' CIC=10 Cause=16 (state=5)
-- Executing (1823867:3) Hangup('557/siuc/8', '') in new stack
-- Spam extension (557, 1023, 3) exited non-zero on '557/siuc/8'
-- 557 hangup: '557/siuc/8' CIC=8 Cause=16 (state=5)
-- Executing (1822867:3) Hangup('557/siuc/6', '') in new stack
-- Spam extension (557, 1022, 3) exited non-zero on '557/siuc/6'
-- 557 hangup: '557/siuc/6' CIC=6 Cause=16 (state=5)
-- Executing (1822067:3) Hangup('557/siuc/4', '') in new stack
-- Spam extension (557, 1021, 3) exited non-zero on '557/siuc/4'
-- 557 hangup: '557/siuc/4' CIC=4 Cause=16 (state=5)
-- Executing (1821867:3) Hangup('557/siuc/2', '') in new stack
-- Spam extension (557, 1020, 3) exited non-zero on '557/siuc/2'
-- 557 hangup: '557/siuc/2' CIC=2 Cause=16 (state=5)
-- Executing (1820867:3) Hangup('557/siuc/0', '') in new stack
-- Spam extension (557, 1019, 3) exited non-zero on '557/siuc/0'
-- 557 hangup: '557/siuc/0' CIC=0 Cause=16 (state=5)
-- Executing (1819867:3) Hangup('557/siuc/29', '') in new stack
```

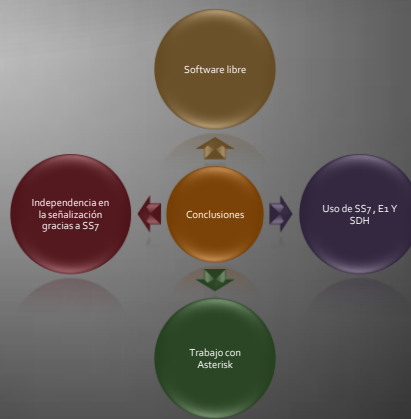
PRUEBAS

- ♦ A continuación se mostrará un video con las pruebas efectuadas

REPRODUCCIÓN DEL VIDEO

CONCLUSIONES

- ♦ Al terminar con la implementación y respectivas pruebas del proyecto se puede concluir que:



RECOMENDACIONES

- Las recomendaciones para el proyecto son:

Jumpers correctamente configurados para E1

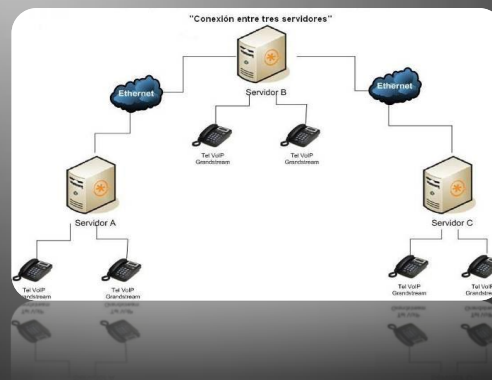
Color del led en la tarjeta debe estar en verde

Gestión de los equipos SDH

Archivos de configuración debidamente configurados

RECOMENDACIÓN DE TRABAJO FUTURO

- Un ejemplo de servicios que se podría utilizar en una empresa gracias a SS7 sería el identificador de llamadas, los números gratuitos 1-800 y características de portabilidad del número telefónico.



GRACIAS POR SU ATENCION

