

VoIP Workshop APRICOT 2010

February 2010

Labs 1 - 4, Asterisk

Lab 5, INOC-DBA

Lab 6-7, Cisco Voice Gateways

Lab 8, CODECS

Lab 9, SIP Call Flow Analysis

Lab 10, Syslog and Call Detail Records (CDRs)

Lab Summary

Server logins: user voip, password discovoice

Servers are statically assigned IPs from the voip subnet 169.223.146.0/24, as follows:

Group #	Extensions	Server IP	Gateway	FXS Port	FXO Port
01	0100 - 0199	169.223.146.101	c2610xm-pots1	1	1
02	0200 - 0299	169.223.146.102	c2610xm-pots1	1	1
03	0300 - 0399	169.223.146.103	c2610xm-pots1	1	1
04	0400 - 0499	169.223.146.104	c2610xm-pots1	2	2
05	0500 - 0599	169.223.146.105	c2610xm-pots1	2	2
06	0600 - 0699	169.223.146.106	c2610xm-pots2	1	1
07	0700 - 0799	169.223.146.107	c2610xm-pots2	1	1
08	0800 - 0899	169.223.146.108	c2610xm-pots2	2	2
09	0900 - 0999	169.223.146.109	c2610xm-pots2	2	2
10	1000 - 1099	169.223.146.110	c2610xm-pots3	1	1
11	1100 - 1199	169.223.146.111	c2610xm-pots3	1	1
12	1200 - 1299	169.223.146.112	c2610xm-pots3	1	1
13	1300 - 1399	169.223.146.113	c2610xm-pots3	2	2
14	1400 - 1499	169.223.146.114	c2610xm-pots3	2	2

c2610xm-pots-1	169.223.146.201
c2610xm-pots-2	169.223.146.202
c2610xm-pots-3	169.223.146.203
c2610xm-e1-1	169.223.146.204
c2610xm-e1-2	169.223.146.205
as5400-e1-1	169.223.146.206

Login details for Cisco boxes: user:voip, password:discovoice

Dial Plan for each group:

'??' is your group number, and provides the first two digits of your extension numbers.

??00 - ??09 SIP phones (password for each, *extension+passwd*, e.g. 2000passwd)

??10 - ??19 Fun with IVRs

??20 - ??29 Music on hold extensions

??30 DB count application

??40 - ??49 Agents

??50 'Helpdesk' queue access

??60 Echo test

??70 Conference bridge

??80 - ??89 Festival text to speech play extensions

??90 Ring the VG200 connected analog phone

??99 Voicemail access

9. Access an outside PSTN line
8. Send calls out via an e1 line (c2600xm-e1-x)
7. Send calls out via a POTS analog line (c2600xm-pots-x)
6. Access INOC-DBA
5. Send calls to another group

Lab 1: Initial Asterisk Install

You may need to tell your Ubuntu box to NOT look for it's CD. Goto System -> Administration -> Software Sources. Uncheck the box 'CDRom with Ubuntu x.xx' then click close.

1. Install Asterisk

```
aptitude install asterisk asterisk-sounds-extra
```

This should install asterisk version 1.6, which includes the Dahdi install, including dahdi_dummy (previously ztdummy, which we need in the lab).

To check that dahdi and the dahdi_dummy driver are loaded:

```
lsmod | grep dahdi
```

You should see something that looks like the following:

```
lab@lab00:~$ lsmod | grep dahdi
dahdi_transcode      7044  0
dahdi_dummy          3336  0
dahdi                 197768  2 dahdi_transcode,dahdi_dummy
crc_ccitt             1852  1 dahdi
```

Set RUNASTERISK=yes in /etc/default/asterisk

```
nano /etc/default/asterisk
```

2. Start Asterisk

```
/etc/init.d/asterisk start
```

Have a look at the available startup options:

```
asterisk -h
```

To connect to the Asterisk CLI:

```
asterisk -r
```

3. Edit Configuration Files in /etc/asterisk/

Set up three SIP peers in sip.conf: **??00**, **??01**, **??02** (where '??' are the extension numbers assigned to your group). Add to the bottom of sip.conf, repeating for each of the three SIP peers:

```
[??00]
type=friend
host=dynamic
username=??00
secret=passwd??00
canreinvite=no
```

```

nat=yes
context=phones
dtmfmode=rfc2833
allow=all

```

Create backup of original extensions.conf:

```
mv extensions.conf orig_extensions.conf
```

Create new extensions.conf with the following:

```

[general]
static=yes
writeprotect=no
autofallthrough=yes
clearglobalvars=no
priorityjumping=yes

[phones]
; remember to replace ?? with your group's numbers!
exten => ??00,1,Dial(SIP/??00)
exten => ??01,1,Dial(SIP/??01)
exten => ??02,1,Dial(SIP/??02)

exten => ??60,1,Answer()
exten => ??60,2,Playback(demo-echotest)
exten => ??60,3,Echo
exten => ??60,4,Playback(demo-echodone)
exten => ??60,5,Hangup

```

Connect to Asterisk (asterisk -r), up the debug output (set verbose 10), and reload the config (reload).

4. Configure Softphone

Download and configure the Xten Xlite Softphone - (<http://www.xten.com/index.php?menu=download>)

Input SIP settings in *Main Menu > System Settings > SIP Pro.. > Default*

<i>Enabled:</i>	Yes
<i>Username:</i>	SIP extension you are configuring (e.g. 2000)
<i>Authorization User:</i>	Same as <i>Username</i>
<i>Password:</i>	extensionpasswd, e.g. 2000passwd
<i>SIP Proxy:</i>	The address of your Asterisk server
<i>OutBound Proxy:</i>	Same as <i>SIP Proxy</i>

You should now be able to call between your three phones.

Call the echo test on ??60 and you should be able to hear yourself!

Lab 2: Basic Asterisk Config

Configure the following, using the extensions given in the Lab summary:

- voicemail for each extension
- a sample IVR
- a meetme conference
- a sample MOH stream

Here's a start on the configuration files:

```

voicemail.conf
[default]
??00 => 1234,User 1,user1@email.address
??01 => 1234,User 2,user2@email.address
??02 => 1234,User 3,user3@email.address

extensions.conf
[phones]
; configure pattern match for local extensions
; e.g. _200X
exten => _??0X,1,Dial(SIP/${EXTEN},15)
exten => _??0X,n,Voicemail(u${EXTEN})
exten => _??0X,n,Hangup()

; allow checking of voicemails. try it out!
exten => ??99,1,VoicemailMain()

; extension to allow dialling the IVR
exten => ??10,1,Goto(ivr-test,s,1)

[ivr-test]
; based on the slides, create an IVR which allows you to
; ring your extensions

```

If you're not sure about how specific applications work, from the Asterisk CLI try:

```

show applications
show application goto

```

Lab 3: Advanced Asterisk Configuration

1. Asterisk Database

Implement the following in extensions.conf:

```

[phones]
; start counting and store count progress in astdb

; check if DB key exists, if not, jump to key_no_exist
; function DB_Exists returns 1 if the key exists, 0 if not
exten => ??30,1,GotoIf(${DB_EXISTS(test/count)}?:key_no_exist)

; begin the counting!
exten => ??30,n(start),Set(COUNT=${DB(test/count)})
exten => ??30,n,SayNumber(${COUNT})
exten => ??30,n,Set(COUNT=${COUNT} + 1)
; update the DB
exten => ??30,n,Set(DB(test/count)=${COUNT})
exten => ??30,n,Goto(start)

; if we got here it is because the key didn't exist in the DB
; create the key
exten => ??30,n(key_no_exist),Set(DB(test/count)=1)
; and jump back to the start to begin counting
exten => ??30,n,Goto(start)

```

Reload Asterisk, and have a look at the Asterisk DB

```
reload
database show
```

Now dial ..30, and look at the DB again. You should see a new key (test/count) in the DB containing the current count.

2. Implement Nightmode

We want the nightmode to work as follows:

We want to create an extension called ..50 for our 'main number'

We will create two new keys in the DB:

```
nightmode/open_time, and nightmode/close_time
```

When a call comes in, we will check to see if we are currently between those two times, and if so ring all three phones. If not, go straight to voicemail

Hints:

To manually set a DB key from the CLI:

```
database put family key value
```

Time based branching:

```
show application gotoif
```

Dialling multiple channels simultaneously:

```
Dial(SIP/1000&SIP/2000&SIP/3000)
```

3. Extension Macro

Look in the original /etc/extensions.conf (you should have moved it to orig_extensions.conf), and use it as a guide.

Create a simple extension macro to dial our extensions and branch to voicemail if not answered.

4. Set up Agents

Edit agents.conf - add three agents for you group to the bottom of the existing file:

```
agent => ??40,1234,Agent one
agent => ??41,1234,Agent two
agent => ??42,1234,Agent three
```

To enable Agent login and logout, add to extensions.conf:

```
[phones]
; hint in CLI, show application AgentCallbackLogin
exten => ??59,1,AgentCallbackLogin()
```

Reload Asterisk, then check the state of Agents before and after a login:

```
show agents
```

5. Set up a Queue

Edit queues.conf - use the existing defaults as a guide. Call the queue helpdesk (this is at the start of the file in []). The important piece is to add to the bottom of queues.conf:

```
member => Agent/??40
member => Agent/??41
member => Agent/??42
```

And in Extensions.conf create a means to enter the queue:

```
[phones]
exten => ??50,1,Queue(helpdesk)
```

Ring the queue with Agents all logged out, and all logged in.

6. Install Festival text to speech

Exit out of Asterisk and install Festival:

```
apt-get install festival
```

Configure Festival for Debian / Ubuntu. Make /etc/festival.conf look like the following:

```
;; Enable access to localhost (needed by debian users)
(set! server_access_list '("localhost\\.localdomain" "localhost"))

;; set italian voice (comment the following 2 lines to use british_american)
(language_italian)
(set! voice_default 'voice_pc_diphone)

;;; Command for Asterisk begin
(define (tts_textasterisk string mode)
  "(tts_textasterisk STRING MODE)
  Apply tts to STRING. This function is specifically designed for
  use in server mode so a single function call may synthesize the string.
  This function name may be added to the server safe functions."
  (utt.send.wave.client (utt.wave.resample (utt.wave.rescale (utt.synth
    (eval (list 'Utterance 'Text string))) 5) 8000)))
;;; Command for Asterisk end
```

To use Festival:

```
exten => 123,1,Festival('Hello World')
exten => 123,2,SetVar(speech='Hello World by variable')
exten => 123,3,Festival('${speech}')
```

Lab 4: Asterisk Exercises

1. Another Extensions Macro

Write an extension macro which looks up a database to get the following information:

```
callerID name
callerID number
Voicemail box
do not disturb flag
```

If the do not disturb flag is set, playback a prompt saying (sorry, <name> doesn't want to be disturbed). Make sure the macro correctly set the CallerID name and number.

2. DB lookup for incoming calls

Write a piece of code that does a DB lookup on inbound calls into the [incoming] context, looks up the number in the database, and uses the result to branch into the appropriate location in the dial plan.

In what circumstances do you think this would be handy?

3. Write a Prompt recording Macro.

This macro will need to take as input the filename to record, and optionally the format to record it in.

The macro needs to:

1. record the prompt
2. let the user play it back
3. let the user confirm they wish to use that prompt
4. save the prompt in the correct location

Note, Festival text to speech is handy to provide instructions here!

4. Write an application to ping a device

Create a context (starting with the 's' extension) which allows you to ping a device.

You'll need to work out how to accept DTMF input, run a ping command external to asterisk, and read the result back to the caller.

Lab 5: Connecting Asterisk to INOC-DBA

You will need to have set up an account and log in to the INOC-DBA administration system to do this.

<http://www.pch.net/inoc-dba/>

1. Set up INOC-DBA to send calls to your Asterisk server.

You need to set up a termination method through the INOC-DBA system to deliver calls to your asterisk server.

For this lab exercise we will set up your INOC-DBA personal extension to terminate calls on your lab asterisk server. Select 'My Phone Numbers' from the menu and populate it accordingly:

Add New INOC-DBA Phone Number for Jonny Martin

On this page, you can define INOC-DBA phone numbers, which will then be available for assignment to different phones or other "termination methods" on the [Termination Methods](#) page.

SELECT ASN	SELECT EXTENSION
9503	<input type="radio"/> No Extension
	<input type="radio"/> Well Known Extensions <input type="text" value="0 Local Operator"/>
	<input checked="" type="radio"/> Personal Extension <input type="text" value="561"/>
	<input type="radio"/> Admin Designated Extension <input type="text"/>
<input type="button" value="Add"/>	<input type="button" value="Cancel"/>

Select 'Termination Methods' from the menu and add the IP address of your lab server, then select that as the termination method for your personal extension.

Add New INOC-DBA Termination Method for Jonny Martin

On this page, you can define termination methods (ways of receiving phone calls), which can be assigned to your phone numbers

Add a new Cisco 7960/7961 or 7940/7941 IP Phone:

Add SIP addresses of external devices like IP PBXes or gateways:

Examples: sip:username@domain.com
username@domain.com
sip:username@192.192.192.192:5060

INOC-DBA Termination Methods for Jonny Martin

SIP Address: 9503*561@sanog.lahai.com

9503*561

2. Configure Asterisk sip.conf

Asterisk needs to be configured to SIP REGISTER itself with the INOC-DBA servers. Add the following to the [general] section of sip.conf:

```
;need to add the register line, which is what Asterisk
;will send to the inoc-dba. the format is
;
; register = > ASN*EXT:password:username@inoc-dba.pch.net/Local_extension
;

register => 9503*561:password:jonny@inoc-dba.pch.net/9503*561
```

Replacing 9503*561 with your INOC-DBA extension, and password:jonny@ with your password and login name.

This statement registers our Asterisk box with INOC-DBA. Inbound calls are sent to the default context.

3. Configure inbound calls

Inbound calls land in the default context. We want these calls to ring a phone, so add something like the following into the [default] context, substituting your details for SIP/2000 and 9503*561.

```
exten => 9503*561,1,Dial(SIP/2000,15)
exten => 9503*561,n,VoiceMail(u2000)
exten => 9503*561,n,Hangup()
```

You may want to have inbound NOC calls ring multiple phones. Configure your INOC-DBA extension to ring multiple phones at once.

A nicer way to implement this is to use a GoTo statement in the default context to send inbound calls to 9503*561 to an extension elsewhere in your dialplan, enabling you to easily change the destination for in-

bound calls. Use this method to send a call to one of your existing extensions. This could be a phone, voicemail, conference, etc.

4. Configure outbound calls

First set up a new SIP peer for INOC-DBA. Add the following peer to sip.conf:

```
[inoc-dba]
type=friend
host=inoc-dba.pch.net
port=5060
username=pchconf
fromuser=9503*561
secret=nothing
canreinvite=yes
context=from-inoc-dba
insecure=very
```

(Remember to use the correct ASN*ext for the fromuser line in the sip peer)

Calls prefixed with a 9 will be sent out to INOC-DBA. We need to first strip the 9, and then set our outgoing callerID correctly. Add the following to the appropriate context in extensions.conf:

```
; This extension is for outgoing calls to inoc-dba
; 9 for an outside-inoc-dba-line
exten => _9.,1,Set(CALLERID(all)=Jonny Martin <9503*561>)
exten => _9.,n,Dial(SIP/${EXTEN:1}@inoc-dba)
exten => _9.,n,Hangup
```

Lab 6. Cisco IOS Voice Gateway i.

In this lab we are going to setup a Cisco router with one FXS interface such that an attached telephone can dial all of the allocated extensions on each asterisk server.

1. Configure SIP peer on Asterisk server

You need to configure a SIP peer for both in and outbound calls to the cisco gateway. In sip.conf add the following peer definition:

```
[cisco]
type=friend
disallow=all
allow=ulaw
canreinvite=no
context=from-cisco
host=a.b.c.d ; see instructor for IP address to use
dtmfmode=rfc2833
insecure=very
```

Note, if you don't have a context [from-cisco] in extensions.conf you will need to create it, and put some extension statements in it!

2. Configure extensions.conf

Inbound calls will land in the [from-cisco] context. Use a GoTo statement to send these calls to the context where you have all your useful extensions defined.

Next we want to create an extension that when dialled from our Asterisk system will dial the cisco analog phone. Add the following the appropriate context to extensions.conf. This example is for group one, using extension 2190

```
exten => 2190,1,Dial(SIP/2190@vg200)
```

The IOS gateway is simply another SIP peer, so you can send calls to it in the same fashion you send calls to any other peer.

3. Configure the VG200

The FXS voice port is already configured for you. In this case, the default IOS settings are all that is required.

Create a dial-peer to ring the analog phone. Login to the gateway and configure the following (changing 2190 for your group's extension, e.g. 2190, 2290):

```
dial-peer voice 2190 pots
  destination-pattern 2190
  port 1/0/0
```

(Remember to replace 21 2190 with your group's allocated extension digits)

Create a dial-peer to send calls to your asterisk server (again, an example for group 1):

```
dial-peer voice 1 voip
  description calls to group 1
  destination-pattern 21..
  session protocol sipv2
  session target ipv4:a.b.c.d ! insert your ip address here
  dtmf-relay rtp-nte
  codec g711ulaw
  no vad
```

(Note here that the '..' in the Cisco config is supposed to stay as '..' - a '.' matches exactly one digit in Cisco pattern match terminology.)

Test that you can make calls to and from the analog phone.

Lab 7. Cisco IOS Voice Gateway ii.

In this lab we are going to setup an E1/T1 interfaces on a Cisco router as an outbound PSTN gateway.

In this example, calls from your softphone to the asterisk server will be prefixed with a 7. Asterisk will send these calls to the Cisco gateway without stripping the 7.

In our fictitious example, calls will be going out to the local PSTN and requires to be prefixed by a 0. The router will first strip the 7, and append a 'telco' access code of 0 before sending the call out one of the E1/T1 interfaces.

The digit stripping is performed on the inbound dial-peer (VoIP in this case), and the prepend on the outbound dial-peer (POTS in this case).

1. Configure SIP peer on Asterisk server

You need to configure a SIP peer for both in and outbound calls to the AS5400 gateway. In sip.conf add the following peer definition:

```
[cisco-e1]
type=friend
disallow=all
allow=ulaw
canreinvite=no
```

```
context=from-cisco-e1
host=a.b.c.d ; check with instructor for address
dtmfmode=rfc2833
insecure=very
```

Note, if you don't have a context [from-cisco-e1] in extensions.conf you will need to create it, and put some extension statements in it!

2. Configure extensions.conf

Inbound calls will land in the [from-cisco-e1] context. Use a GoTo statement to send these calls to the context where you have all your useful extensions defined. In this case we want inbound calls to ANY number to be met with music on hold.

We want to create an extension match that matches strings starting with a 7, and send the call to the router:

```
exten => _7.,1,Dial(SIP/${EXTEN}@as5400)
```

Why do we use \${EXTEN} in the dial string in this case?

3. Configure the E1 gateway

The E1/T1 port will already be configured for you. First we need to create a translation rule to strip the leading 7 of incoming VoIP calls. This translation rule will be called 10+<group number> e.g. 101 for group one.

```
translation-rule 101
Rule 1 ^71.% 1
Rule 2 ^72.% 2
Rule 3 ^73.% 3
Rule 4 ^74.% 4
Rule 5 ^75.% 5
Rule 6 ^76.% 6
Rule 7 ^77.% 7
Rule 8 ^78.% 8
Rule 9 ^79.% 9
```

The translation rule for prepending a 0 for outbound POTS calls is a little simpler. This rule will be called 20+<group number> e.g. 201 for group one.

```
translation-rule 201
Rule 1 ^.% 0
```

Create a dial-peer to match incoming VoIP calls from your asterisk server (remember that a call consists of two dial-peers. This dial-peer will be called 100+<group number>, e.g. 1001 for group one:

```
dial-peer voice 1001 voip
description calls from group 1
answer-address 21..
destination-pattern 21..
translate-outgoing called 101
session protocol sipv2
session target ipv4:a.b.c.d ! see instructor for ip address
dtmf-relay rtp-nte
codec g711ulaw
no vad
```

The answer-address line tells this dial-peer to match incoming calls from only your asterisk server. In this case, session protocol and target is correctly setup, however at this stage it is not being used as no inbound calls are configured.

Create a dial-peer to send calls out the first E1/T1 interface on the router. This dial-peer will be called <group number>, so substitute your group's number when configuring this. We will be using the the translation pattern to prepend a 0 that we configured up earlier. For group one:

```
dial-peer voice 1 pots
destination-pattern T
translate-outgoing calling 201
direct-inward-dial
port 1/0:D
```

Once you have completed this, try making a call. If it fails, perform some debug both on your Asterisk server, and on the gateway to try and work out why.

Some useful IOS voice commands:

```
show call active voice brief      ! show voice calls currently in progress
show call history voice brief     ! show recent voice calls

show controller controller-id  ! show details of interface controller
show voice port                  ! show voice port configuration

show dial-peer voice [summary | id#]

test translation-rule            ! test a translation pattern
e.g. test translation-rule 201 64212304323
```

Lab 8. CODECs

This lab aims to give you real world experience making calls over real satellite IP links with different CODECs and settings.

We will be making calls to an asterisk server back in New Zealand to an echo test, and the PSTN.

1. Asterisk configuration

You'll need the following SIP peer configured on your asterisk server (use apricot<group number> for the peer name):

```
[nz]
type=friend
disallow=all
allow=alaw
callerid=your name <2100>
dtmfmode=rfc2833
canreinvite=no
nat=no
host=a.b.c.d
username=voip1
fromuser=voip1
secret=voip1
```

We'll see our dialplan up such that calls starting with 1 are sent to NZ, after having the 1 stripped:

In extensions.conf add a route to the NZ asterisk box:

```
exten => _1.,1,Dial(SIP/${EXTEN:1}@nz)
```

2. Check connectivity to NZ server

We want to see what the connectivity to the NZ server looks like, a ping and traceroute will give us an idea of what this is like. From a shell prompt on your asterisk server:

```
ping a.b.c.d
mtr a.b.c.d
```

What does the path look like?

What is the round trip latency? What might a voice call sound like?

3. Make some calls

Make a call to the NZ server. The NZ server is configured with the following dialplan:

```
200  echo test
222  music on hold

0...  domestic NZ numbers (e.g. 021 2304323 to dial Jonny's cellphone)
00... international numbers (e.g. 00 682 xxxxx to dial Rarotonga)
```

(Careful when making PSTN calls, as call quality will be highly variable due to the more limited bandwidth into NZ, and the number of simultaneous call attempts!)

Once you have successfully made a call, try further calls to the echo test and music on hold using other codecs. Change the 'allow=' line in your nz SIP peer to try the following codecs:

```
gsm      - GSM codec
ilbc     - Internet low bandwidth codec
ulaw     - G.711 ulaw
speex    - Speex codec
g726     - G.726.1 codec
```

Lab 9. SIP Call Flow Analysis

This lab will cover the installation of the sip_scenario call flow analysis tool. This provides a pretty html interface to captured SIP call traffic.

1. Install SIP Scenario Callflow Generator

```
cd /home/voip/
mkdir callflow
cd callflow
wget http://www.iptel.org/~sipsc/index/sip\_scenario.v1.2.7.zip
unzip sip_scenario.v1.2.7.zip
```

edit sip_scenario.pl and change the first line from:

```
#!/usr/local/bin/perl -w
--to--
#!/usr/bin/perl -w
```

2. Capture sip traffic:

To capture all traffic (careful, there might be a lot of traffic!):

```
tcpdump -s0 -w capture_filename
```

To capture just sip traffic:

```
tcpdump -s0 -w capture_filename2 port 5060
```

3. Generate pretty callflow diagrams

```
./sip_scenario.pl capture_filename
```

Then drop the html files in a webserver directory, or open them directly with the file browser on your Linux machine.

Lab 10. Syslog and Call Detail Records

In this lab we are going to set up a syslog server on our lab servers, and configure our gateways to send Call Detail records to it.

1. Server Side syslog install

Syslog is quite limited, so use syslog-ng

```
aptitude install syslog-ng
```

This will remove the old syslog package and replace it with syslog-ng which is configured to replicate how syslog was configured.

```
nano /etc/syslog-ng/syslog-ng.conf
```

Add;

```
source s_remote {
    udp();
};
```

This adds a new source called s_remote and accept syslog messages from the syslog UDP port.

```
destination df_remote{ file("/var/log/remote/$HOST.log"); };
```

This creates a new syslog logging target which is a file, it will use the \$HOST macro which will be filled in with the source address the messages came from. If in the options section use_dns(); is set to no then it will use just the IP address, or if it is set to yes it will use the RDNS for the IP.

Now we create a bridge between the logging source and destination like this;

```
log {
    source(s_remote);
    destination(df_remote);
};
```

restart syslog-ng, create the /var/log/remote/ directory and you are away. This is not the most secure method of setting it up, but the fastest, if it is going to be used in the real world you should also set up filters to ensure that not just anyone can log to you and also to perhaps use filequotas so that it doesn't fill your disks up. Also you should set up logfile rotations.

2. Configure Cisco gateway to send syslog messages

On the Cisco box configuration is pretty simple.

```
logging host A.B.C.D
logging trap 0-7 (0 being almost nothing, 7 being the most verbose)
```

If your Cisco supports it you might want to log your call records via syslog as well. The AS5400 supports this but the c2600XMs don't.

```
calltracker enable
calltracker call-record verbose
```

Lab 11. Cisco QoS

In this lab we are going to set up very basic QoS between two Cisco routers to provide priority to voice traffic

1. Configure Access list for marking

Note that we can only configure one access list so make sure you add to the following access list on the router, and don't replace what is already there!

This needs to be done on the router that has your analogue phone connected to it.

```
access-list 100 remark ACL to match VOIP traffic
access-list 100 permit udp any any eq 4569
access-list 100 permit udp any any eq 5004
access-list 100 permit udp any any eq 5060
access-list 100 permit ip any host INSERT-YOUR-SERVER-IP-HERE
```

We will use this access-list to match voice media and signalling traffic.

What traffic is the explicit ports matching?

2. Configure Low Latency Queuing

Configuring LLQ for voice traffic on cisco routers is quite straight forward. Configure the following on your router ('!' represents a commented line, there is no need to type those lines into the router).

```
! create a class that matches the traffic in the access-list above
class-map voip
  match access-group 100
!
! create a policy map to queue based on our class called 'voip'
policy-map llq-voip
  class voice
    ! configure 160kbps priority bandwidth for class voip
    priority 160
  class class-default
    fair-queue
```

3. Apply the service policy to an interface

We need to apply our service-policy to an interface now. In our case we are using the onboard fast ethernet interface to send traffic to our gateway.

```
interface fa0/0
  service-policy output llq-voip
```

In which direction has this QoS configuration affected out traffic?

How might we handle inbound traffic?

4. Verifying QoS operation

Verifying QoS from the router CLI is achieved with the following commands:

```
show policy-map <policy-map-name>
show class-map <class-map-name>
```

```
show policy-map interface <interface>
show interface <interface>
```

The Show Policy-map command displays the contents of a policy map, including the priority setting in a specific policy map if one is included. It shows the classes that belong to the priority queue along with what traffic belongs to the default-class. It should be noted the default queue uses weighted-fair queuing.

The Show class-map command shows the criteria for a packet to become a member of a class.

The Show policy interface command shows what class-maps are configured under a policy-map applied to the named interface. You can determine if the desired QoS policy is active on the interface, and how much of the traffic meets the requirements to become a member of the class. It also tells how many packets have been dropped from the output queue. If there are drops present it is because congestion was present in the circuit and the queues started to drop packets to make way for the high priority traffic.

The show interface command gives you the interface statistics, and it also gives you how many output queue drops have occurred on the interface. This is a quick way to determine if there has been congestion and if packets are being dropped. It also tells you if the QoS commands are applied to the physical or logical interface. In this case, it is applied to the logical because the queuing mechanism is for each virtual channel or VC.

5. Hierarchal Shaping

Implement a hierarchal shaper based on the following configuration. By using a very low shaping target for the parent policy-map you will be able to easily exercise the child shaper.

```
policy-map shaper-parent
  class class-default
    shape average 80000
    service-policy shaper-child

policy-map shaper-child
  class voip
    priority 80
```

Other Lab Notes

1. Meddling with packets

In the lab we used the tc (traffic control) linux command to modify packets. This allowed us to set drop, latency, and jitter probabilities to enable us to simulate the parameters of real links. We could also take things to the extreme and test how various VoIP codecs and devices perform across very bad links.

Full documentation for the use of tc is at: <http://www.linuxfoundation.org/en/Net:Netem>

2. Connecting two Asterisk boxes together via a SIP trunk.

Example config, connecting group 1 to group 2 via an authenticated SIP trunk:

GROUP 1

sip.conf

```
[group2]
type=friend
host=169.223.129.202
allow=all
username=group1
fromuser=group1
secret=supersecret
nat=no
context=from-other-groups
dtmfmode=rfc2833
```

extensions.conf

```
[phones]
exten => _02XX,1,Dial(SIP/${EXTEN}@group2)

[from-other-groups]
exten => _01XX,1,GoTo(phones,${EXTEN},1)
```

GROUP 2

sip.conf

```
[group1]
type=friend
host=169.223.129.201
allow=all
username=group2
fromuser=group2
secret=supersecret
nat=no
context=from-other-groups
dtmfmode=rfc2833
```

extensions.conf

```
[phones]
exten => _01XX,1,Dial(SIP/${EXTEN}@group1)

[from-other-groups]
exten => _02XX,1,GoTo(phones,${EXTEN},1)
```

3. tcpdump example

To capture packets from your softphone to your asterisk server, while filtering out ssh traffic:

```
tcpdump -i eth0 -n host 169.223.x.x and not port ssh
  (where x.x = ip of laptop with softphone)
```