**Setup Kamailio IMS Servers (P-CSCF / I-CSCF / S-CSCF)**

You can build Kamailio as IMS servers (P-CSCF / I-CSCF / S-CSCF). To setup Kamailio as IMS servers, Kamailio-4.2.0 was picked up. A single Ubuntu 12.04 machine was used to run HSS, P-CSCF, I-CSCF, S-CSCF and MySQL Server. Also same machine was used to run as DNS server (bind9). In a typical commercial setup, probably you need to run these components in separate machines.

To make use of Kamailio as IMS servers, at a higher level you need to mainly do -

* Prerequisites
* Setup static IP address
* DNS Setup.
* Build Kamailio from source
* Configure Kamailio server as P-CSCF
* Configure Kamailio server as I-CSCF
* Configure Kamailio server as S-CSCF
* Build HSS from source
* Configure HSS so that it connects with I-CSCF and S-CSCF
* Add the user(s) in HSS

**Prerequisites**

Please install below packages in machine where all P-CSCF, I-CSCF and S-CSCF are executing.

apt-get install flex
apt-get install bison

**Setup static IP address**

Choose an IP address that is not used by anybody in your LAN. Then follow the instructs given [here](https://loadmultiplier.com/node/67). Please note that you can ommit the wlan section in /etc/network/interface file, if you do not have a wlan interface like datacard etc.

**DNS Setup**

First you think of a domain, what you would like to use for IMS test setup. Then follow the instructs given [here](https://loadmultiplier.com/node/64). Please note that in example group1-imslab11.in is taken as domain name. You can choose a unique domain name instead of group1-imslab11.in.

With this networking pre-requisites are done. Next, lets move to build Kamailio from source.

**Build Kamailio from source**

1. Download the latest source from [here](http://www.kamailio.org/pub/kamailio/latest/src/). Alternatively pick a right version from [here](http://www.kamailio.org/pub/kamailio/).
2. Copy the downloaded tar file to a location of your choice, say to /usr/local/ims-kamailio/ path.
3. Untar the downloaded tar file using tar command as shown below.

tar -xvzf *downloaded-tar-file*

1. Change directory to Kamailio source folder
2. Build all related modules using below command.

make proper
make include\_modules="ims\_usrloc\_pcscf ims\_registrar\_pcscf dialog\_ng xmlrpc \
  db\_mysql cdp cdp\_avp ims\_icscf \
  presence ims\_usrloc\_scscf ims\_registrar\_scscf ims\_auth ims\_isc ims\_charging" cfg
make all
make install

1. Now you have built the Kamailio. Next you need to configure CSCF components.

**Configure Kamailio server as P-CSCF**

You will be dealing with two config files pcscf.cfg and kamailio.cfg.
Prior to go through these steps, you may download [pcscf.cfg](https://loadmultiplier.com/sites/default/files/kamailio/pcscf/pcscf.cfg) and [kamailio.cfg](https://loadmultiplier.com/sites/default/files/kamailio/pcscf/kamailio.cfg), so that you can refer confgiurations as you go through below steps.

Let's install P-CSCF in /etc/kamailio path. You can choose a different path if required.

1. Create /etc/kamailio folder if not exists, and move to /etc/kamailio folder

mkdir /etc/kamailio
cd /etc/kamailio

1. Copy example pcscf folder to /etc/kamailio path

cp -rf /usr/local/ims-kamailio/kamailio-4.2.0/examples/pcscf ./

1. Chnage to pcscf directory

cd ./pcscf

1. Now you can see pcscf.cfg and kamailio.cfg. File pcscf.cfg is actually included in kamailio.cfg file. Modify pcscf.cfg and kamailio.cfg as per your environment details.
2. Open pcscf.cfg, and modify
	* **listen=** lines for tcp and udp and tls cases. Also provide the port number where P-CSCF will listen for incoming connections.
	Example

*listen=udp:10.10.10.100:4060
listen=tcp:10.10.10.100:4060
listen=tls:10.10.10.100:4060*

Here 10.10.10.100 is IP address of P-CSCF machine, and port 4060 is choosen as P-CSCF listen port.

* + **alias=**line, here you put alias name for P-CSCF.
	Example

*alias=pcscf.group1-imslab11.in*

For your case, what value you will put for alias depends on your DNS entries added previously. It is combination of P-CSCF name and domain name. Whatever you put in alias, should be a resolveable name (meaning where you will run IMS client, from that machine you should be able to ping to alias).

* + Set the port macro , it is used in kamailio.cfg file.
	Example

*#!define PORT 4060*

* + Set the network macros as shown below

*#!subst "/NETWORKNAME/group1-imslab11.in/"
#!subst "/HOSTNAME/pcscf.group1-imslab11.in/"
#!define HOSTNAME\_IP pcscf.group1-imslab11.in
#!define HOSTNAME\_ESC "pcscf\.group1-imslab11\.in"*

* + Set the feature macros as given below

*#!define WITH\_DEBUG
#!define WITH\_NAT
##!define FORCE\_RTPRELAY
##!define WITH\_TLS
#!define WITH\_XMLRPC
#!define WITH\_ANTIFLOOD
##!define WITH\_RX
##!define WITH\_TCP
#!define WITH\_SBC
##!define WITH\_WEBSOCKET
#!define WITH\_IMS\_HDR\_CACHE
#!define WITH\_NATPING*

Please note that lines starting with double hash (##) are commented lines.

1. Now you need to modify kamailio.cfg file. Typically default path for Kamailio server is /etc/kamailio. But we are using /etc/kamailio/pcscf path. So this path needs to be modified throughtout in kamailio.cfg file. In addition to this mpath needs to be modified. Now open kamailio.cfg file and do below modifications.
	* Modify

*modparam("cdp","config\_file","/etc/kamailio/pcscf.xml")*

to

*modparam("cdp","config\_file","/etc/kamailio/pcscf/pcscf.xml")*

* + Modify

*modparam("tls", "config", "/etc/kamailio/tls.cfg")*

to

*modparam("tls", "config", "/etc/kamailio/pcscf/tls.cfg")*

* + Comment dispatcher related lines (both in modparam and logic routines). If you are not sure how to comment dispatcher stuff in logic routines download the example configutaion files given towards end of this article.
	+ Modify mpath line to as shown below.

*mpath="/usr/local/ims-kamailio/kamailio-4.2.0/output/lib64/kamailio/modules/"*

1. You had built Kamailio earlier. Copy the executable to /etc/kamailio/pcscf path as pcscf.
2. Run PCSCF as. /pcscf -c and see if any config errors are there. If config errors present, first resolve those.
3. Now you are done with P-CSCF setup.

**Configure Kamailio server as I-CSCF**

Prior to go through these below steps, you may download [icscf.cfg](https://loadmultiplier.com/sites/default/files/kamailio/icscf/icscf.cfg), [kamailio.cfg](https://loadmultiplier.com/sites/default/files/kamailio/icscf/kamailio.cfg), [icscf.xml](https://loadmultiplier.com/sites/default/files/kamailio/icscf/icscf.xml) and [icscf.mysql.sql](https://loadmultiplier.com/sites/default/files/kamailio/icscf/icscf.mysql.sql.tar.gz), so that you can refer confgiurations as you go through below steps.
Let's install I-CSCF in /etc/kamailio path. You can choose a different path if required.

1. Install mysql-server as I-CSCF needs it.

apt-get install mysql-server

1. Change to /etc/kamailio folder

cd /etc/kamailio

1. Copy example icscf folder to /etc/kamailio path

cp -rf /usr/local/ims-kamailio/kamailio-4.2.0/examples/icscf ./

1. Chnage to icscf directory

cd ./icscf

1. Now you can see icscf.cfg and kamailio.cfg. File icscf.cfg is actually included in kamailio.cfg file. Modify icscf.cfg and kamailio.cfg as per your environment details.
2. Open icscf.cfg, and modify
	* **listen=** lines for tcp and udp and tls cases. Also provide the port number where I-CSCF will listen for incoming connections.
	Example

*listen=udp:10.10.10.100:4070
listen=tcp:10.10.10.100:4070
listen=tls:10.10.10.100:4070*

Here 10.10.10.100 is IP address of I-CSCF machine, and port 4070 is choosen as I-CSCF listen port.

* + **alias=**line, here you put alias name for I-CSCF.
	Example

*alias=icscf.group1-imslab11.in*

For your case, what value you will put for alias depends on your DNS entries added previously. It is combination of I-CSCF name and domain name. Whaever you put in alias, should be a resolveable name (meaning where you will run IMS client, from that machine you should be able to ping to alias).

* + Set the port macro , it is used in kamailio.cfg file.
	Example

*#!define PORT 4070*

* + Set the network macros as shown below

*#!subst "/NETWORKNAME/group1-imslab11.in/"
#!subst "/HOSTNAME/pcscf.group1-imslab11.in/"*

* + In DB\_URL line, set database details properly
	+ In DB\_URL2 line, set database details properly
	+ Set the feature macros as given below

*#!define WITH\_XMLRPC*

1. Now you need to modify kamailio.cfg file. Typically default path for Kamailio server is /etc/kamailio. But we are using /etc/kamailio/icscf path. So this path needs to be modified throughtout in kamailio.cfg file. In addition to this mpath needs to be modified. Now open kamailio.cfg file and do below modifications.
	* Modify

*modparam("cdp","config\_file","/etc/kamailio/icscf.xml")*

to

*modparam("cdp","config\_file","/etc/kamailio/icscf/icscf.xml")*

* + Modify

*modparam("tls", "config", "/etc/kamailio/tls.cfg")*

to

*modparam("tls", "config", "/etc/kamailio/icscf/tls.cfg")*

* + Comment dispatcher related lines (both in modparam and logic routines). If you are not sure how to comment dispatcher stuff in logic routines download the example configutaion files given towards end of this article.
	+ Modify mpath line to as shown below.

*mpath="/usr/local/ims-kamailio/kamailio-4.2.0/output/lib64/kamailio/modules/"*

1. You had built Kamailio earlier. Copy the executable to /etc/kamailio/icscf path as icscf.
2. Run I-CSCF as ./icscf -c and see if any config errors are there. If config errors present, first resolve those.
3. Next you need to setup mysql part. Create a database **icscf** with user **icscf**. You can follow below steps to create database and user.
4. Enter command as shown below

mysql -uroot -p

Enter mysql root password. You will be at mysql prompt. Execute below commands at mysql prompt.

create database icscf;
create user 'icscf'@'localhost' IDENTIFIED BY 'your-password';
grant all privileges on icscf.\* to 'icscf'@'localhost';

1. Now user and database are created. Exit mysql prompt by typing exit.
2. Import icscf.mysql.sql file

mysql -uroot -p icscf < icscf.mysql.sql

It will ask mysql root password. Enter the password. It will import icscf.mysql.sql file to mysql.

1. Next you need to modify icscf.xml file. Check the example [icscf.xml](https://loadmultiplier.com/sites/default/files/kamailio/icscf/icscf.xml) and modify it accordingly. Important points to note here, you can set realm to domain name, in this case it is group1-imslab11.in. You also need to set the FQDNs properly as shown in example file. Also you need to set the hss port and icscf (acceptor) ports accordingly. If ports are not set properly handset between HSS and I-CSCF would not go through.
2. Now you are done with I-CSCF setup.

**Configure Kamailio server as S-CSCF**

Prior to go through these below steps, you may download [scscf.cfg](https://loadmultiplier.com/sites/default/files/kamailio/scscf/scscf.cfg), [kamailio.cfg](https://loadmultiplier.com/sites/default/files/kamailio/scscf/kamailio.cfg) and [scscf.xml](https://loadmultiplier.com/sites/default/files/kamailio/scscf/scscf.xml), so that you can refer confgiurations as you go through below steps.
Let's install S-CSCF in /etc/kamailio path. You can choose a different path if required.

1. Change to /etc/kamailio folder

cd /etc/kamailio

1. Copy example scscf folder to /etc/kamailio path

cp -rf /usr/local/ims-kamailio/kamailio-4.2.0/examples/scscf ./

1. Chnage to scscf directory

cd ./scscf

1. Now you can see scscf.cfg and kamailio.cfg. File scscf.cfg is actually included in kamailio.cfg file. Modify scscf.cfg and kamailio.cfg as per your environment details.
2. Open scscf.cfg, and modify
	* **listen=** lines for tcp and udp and tls cases. Also provide the port number where S-CSCF will listen for incoming connections.
	Example

*listen=udp:10.10.10.100:4080
listen=tcp:10.10.10.100:4080
listen=tls:10.10.10.100:4080*

Here 10.10.10.100 is IP address of S-CSCF machine, and port 4080 is choosen as S-CSCF listen port.

* + **alias=**line, here you put alias name for S-CSCF.
	Example

*alias=scscf.group1-imslab11.in*

For your case, what value you will put for alias depends on your DNS entries added previously. It is combination of S-CSCF name and domain name. Whaever you make in alias, should be a resolveable name (meaning where you will run IMS client, from that machine you should be able to ping to alias).

* + Set the port macro , it is used in kamailio.cfg file.
	Example

*#!define PORT 4080*

This section describes how to setup DNS server in Ubuntu 12.04 using bind9.

Login as root to system and follow below steps

1. Remove bind9 if present

apt-get remove bind9
apt-get --purge remove bind9
rm -rf /etc/bind

1. Install bind9

apt-get install bind9

1. Lets say static ip will be used for system, and also lets hard-code dns servers for system. So you need to modify **/etc/network/interface** file. The file should look as below.

iface lo inet loopback

auto eth0
iface eth0 inet static
address 192.168.1.100
netmask 255.255.255.0
gateway 192.168.1.1
network 192.168.1.0
broadcast 192.168.1.255
dns-nameservers 192.168.1.100 127.0.0.1 8.8.8.8

1. You need to setup managed as false in network manager config file. Go to **/etc/NetworkManager/NetworkManager.conf** file.
The file /etc/NetworkManager/NetworkManager.conf should look as below.

[main]
plugins=ifupdown,keyfile

no-auto-default=38:60:77:93:0D:42,

[ifupdown]
managed=true

Please note that for no-auto-default, you have to put your system MAC address.

1. You need to setup your **/etc/bind/named.conf** file. In this particular example, we are planning to setup domain as **group1-imslab11.in**. Under that domain, we are planning to have 3 hosts pcscf, icscf and scscf. If you follow this example properly, at the end of this example, you can ping to
**group1-imslab11.in**
**pcscf.group1-imslab11.in**
**scscf.group1-imslab11.in**
**icscf.group1-imslab11.in**

Now add/modify the named.conf file should look as below.

// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, \*BEFORE\* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";
include "/etc/bind/zones.rfc1918";
include "/etc/bind/rndc.key";

controls {
inet 127.0.0.1 port 953
allow {127.0.0.1;} keys {"rndc-key";};
};

zone "group1-imslab11.in" {
type master;
file "/etc/bind/open-ims.dnszone";
notify no;
};

zone "1.168.192.in-addr.arpa" IN {
type slave;
file "/etc/bind/open-ims-rev.dnszone";
allow-query {any;};
masters {192.168.1.100;};
notify no;
};

1. Now the forward zone file (oen-ims.dnszone) should look as below.

$ORIGIN group1-imslab11.in.
$TTL 1W
@ 1D IN SOA group1-imslab11.in. root.group1-imslab11.in. (
2006101001 ; serial
3H ; refresh
15M ; retry
1W ; expiry
1D ) ; minimum
1D IN NS necs04.group1-imslab11.in.

pcscf 1D IN A 192.168.1.100
\_sip.pcscf 1D SRV 0 0 4060 pcscf
\_sip.\_udp.pcscf 1D SRV 0 0 4060 pcscf
\_sip.\_tcp\_.pcscf 1D SRV 0 0 4060 pcscf

icscf 1D IN A 192.168.1.100
\_sip 1D SRV 0 0 5060 icscf
\_sip.\_udp 1D SRV 0 0 5060 icscf
\_sip.\_tcp 1D SRV 0 0 5060 icscf

group1-imslab11.in. 1D IN A 192.168.1.100
necs04.group1-imslab11.in. 1D IN A 192.168.1.100
group1-imslab11.in. 1D IN NAPTR 10 50 "s" "SIP-D2U" "" \_sip.\_udp.group1-imslab11.in.
group1-imslab11.in. 1D IN NAPTR 10 50 "s" "SIP-D2T" "" \_sip.\_tcp.group1-imslab11.in.

scscf 1D IN A 192.168.1.100
\_sip.scscf 1D SRV 0 0 6060 scscf
\_sip.\_udp.scscf 1D SRV 0 0 6060 scscf
\_sip.\_tcp.scscf 1D SRV 0 0 6060 scscf

hss 1D IN A 192.168.1.100
presence 1D IN CNAME hss

1. Now you setup reverse zone file (open-ims-rev.dnszone).
The file open-ims-rev.dnszone looks as below.

$TTL 86400
@ IN SOA necs04.group1-imslab11.in. root.group1-imslab11.in. (
2006101001 ; serial
3H ; refresh
15M ; retry
1W ; expiry
1D ) ; minimum
IN NS necs04.group1-imslab11.in

; imslan Servers
100 PTR pcscf.group1-imslab11.in.
100 PTR icscf.group1-imslab11.in.
100 PTR scscf.group1-imslab11.in.
100 PTR hss.group1-imslab11.in.

1. Now you have configured DNS server. Restart the service **/etc/init.d/bind9 restart**
2. From a different machine, point DNS server to new DNS server that you just setup now.
3. Now ping to any below host, you should be able to ping those.
**group1-imslab11.in**
**pcscf.group1-imslab11.in**
**scscf.group1-imslab11.in**
**icscf.group1-imslab11.in**

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