OSPrey LCADS Local Routing Feature

Introduction

The iconectiv Local Calling Area Data Source (LCADS) database can be imported into OSPrey and used to identify calls where the calling and called numbers are in the same local calling area. The LCADS data is provided as two space delimited files: LCA_CLUSTERS.TXT and LCA.TXT. The following table describes the LCA.TXT file. The three data fields used by the OSPrey LCADS application are highlighted in yellow.

1) NPANXX of the calling and called numbers.
2) CLUST (cluster ID) associated with each NPANXX.
3) CP_BUS, business calling plan number of the CLUST.

Field	Size	Description
NPANXX	6	NPA/NXX, the first 6 digits of a phone number.
SSC	4	Special Service Codes (up to 4) taken from the LERG. This field can be used to help identify extended/premium local calling plans within a given area.
STATUS	1	E = Established, D = Deleted, or blank
EFFDATE	8	Establishment date or deletion date
FILLER	4	
COTYPE	1	E = Wireline (“End Office”) or W = Wireless
CLUST	10	Cluster (Rate Center or sub–Rate Center) ID
ST	2	2-character state or province abbreviation
OCN	4	LERG OCN associated with NPA/NXX
FILLER	4	
INCUMBENT	4	OCN associated with tariff data
FILLER	14	
CITY	30	30-character city name as seen in General Exchange Tariff
RCNAME	10	10-character rate center name as used in LERG
MAP_BUS	2	ID used in LCA_CPMAP for the business calling plans available for this NPA/NXX
MAP_RES	2	ID used in LCA_CPMAP for residential calling plans available for this NPA/NXX
CP_BUS	2	Base business calling plan number
CP_RES	2	Base residential calling plan number
RC_LATA	5	3- or 5-character LATA of the NPA/NXX rate center
RC_V	5	Rate center V coordinate
RC_H	5	Rate center H coordinate
DIALPATTRN	2	Dialing-pattern number for this NPA/NXX
FILLER	51	
SWITCH_CLLI	11	11-character switch CLLI code from LERG
SWITCH_V	2	Switch V Coordinate
SWITCH_H	2	Switch H Coordinate

OSPrey will search this table twice for each call. Once to the find the ClusterId and CP_BUS for the calling number and then again for the called number. Note: The OSPrey LCADS application

will use the called Location Routing Number (LRN), not the called telephone number to search the LCA.TXT data.

The following table describes the LCA_CLUSTERS.TXT file.

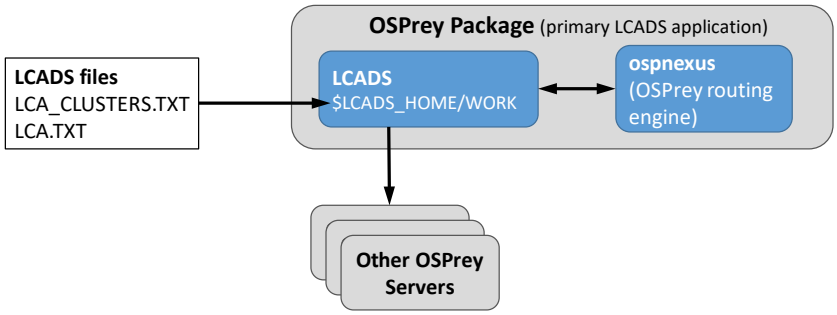
Field	Size	Description
ORIG_CLUST	10	Originating NPA/NXX Cluster ID
CPNUM	2	Calling Plan Number
TERM_CLUST	10	Terminating NPA/NXX Cluster ID

If the ClusterID for the originating and terminating NPANXXs and the Calling Plan Number are on the same row, then the call is a local call.

Overview of LCADS Application in OSPrey

The application in the OSPrey package for using the LCADS data is named LCADS. The LCADS application is very similar to the `numberupdate` application used for managing the local number portability database from the Number Portability Administration Center (NPAC).

The following diagram provides a summary overview of how the LCADS application is implemented with the OSPrey Package. The `ospnexus` application is the OSPrey routing engine. The two LCADS files from iconectiv (LCA_CLUSTERS.TXT and LCA.TXT) must be copied to the `$LCADS_HOME/WORK` directory. The LCADS application will process these two files and load them into local memory. The LCADS application will also replicate the LCADS data to all other OSPrey servers. If LCADS is present, the `ospnexus` application will query the LCADS data in memory to determine if a call is local. If the call is local, OSPrey will temporarily prepend the called number with a ### prefix to indicate the call is local.



The OSPrey package includes multiple applications. The following directory listing shows the LCADS application in the OSPreyPackage directory.

```
[ospadmin@osprey ospnexus]$ cd /home/ospadmin/OSP/OSPreyPackage/
[ospadmin@osprey OSPreyPackage]$ ls
enum                                freeradius-2.1.12_osp-2.3.1
LCADS                               numberupdate
ospnexus                            PostInstallationFiles
txt2osp                             enum_1.1.2  jdk
LCADS-1.0.0                         NumberUpdate-1.3.1
ospnexus_5.31.1                     RELNOTES.txt
freeradius  jdk1.8.0_45             LICENSE.txt
opensips                            ospnexus_5.32.0
Source                              txt2osp-1.8.1
```

Summary of Important LCADS Directories

```
[ospadmin@osprey LCADS]$ ls
ARCHIVE  etc  lib  LOG  RELNOTES.txt  unix  WORK
```

Directory	Description
ARCHIVE	After the `LCA_CLUSTERS.TXT` and `LCA.TXT` files in the WORK directory are processed by LCADS, they are moved to the ARCHIVE directory.
etc	Holds `LCADS.etc` configuration file
LOG	Log files for LCADS operation
unix/run	Run and stop scripts for LCADS
unix/utils	Utility scripts for deleting old log files and old files in the ARCHIVE directory. By default, files older than 45 days will be deleted. Users should configure cron to run these utilities periodically.
WORK	New LCADS files should be copied to the WORK directory.

Preparation

OSPrey Changes

1) Copy LCA_CLUSTERS.TXT and LCA.TXT files to the `$LCADS_HOME/WORK` directory, or `/home/ospadmin/OSP/OSPreyPackage/LCADS/WORK` directory, of the OSPrey server that will be the primary LCADS application.

2) Configure the IP addresses of the other OSPrey servers that will receive updated LCADS data from the primary LCADS application. Go to the `$LCADS_HOME/etc` directory or `/home/ospadmin/OSP/OSPreyPackage/LCADS/etc`. Use a text editor to edit the `NexusServers` variable in the `LCADS.etc` file. The following text shows the section of the file that must be updated.

```
## List of OSPrey Servers
## ======================
## This list defines the OSPrey servers which ReplicateNPACUpdates will
## communicate with.  The variable name is NexusServer and the expected value
## is an IP address, or domain name, followed by port 5045.  Each
## NexusServer value should be separated by a comma.
## Example: NexusServers=localhost:5045,1.2.3.4:5045
##
NexusServers=127.0.0.1:5045
```

3) Configure OSPrey servers to use the dialed number or LRN to perform the LCADS look-up.

a) Log into the OSPrey server as user ospadmin.

b) Change directory to `$OSPrey_HOME` which is also the `/home/ospadmin/OSP/OSPreyPackage/ospnexus directory`

c) Edit following section of the `start_osp_server.sh` script:

```
# Called number used for searching LCADS for terminating cluster
#########################################################################
# If set to Yes, use Called Number After LNP Look Up
# If set to No,  use Called Number After Pre-Routing Translation
#
USE_LRN_FOR_SEARCHING_LCADS_TERMINATING_CLUSTER=No
```

Leave the default value = No if the dialed number should be used to determine if the call is a local call. If this value = yes, the calling number and the LRN will be used with the LCADS table to determine if the call is local.

NexOSS Changes
The LCADS lookup requires the calling number to be in eleven digit format (1-NPA-NXX-XXXX). If the calling number in the SIP INVITE sent to OSPrey is in ten digit format (NPA-NXX-XXXX), then use Calling Number Pre-Routing Number Translation Rules in NexOSS to add a 1 prefix to the calling number. Replicate the number translation changes in NexOSS to OSPrey.

Running the LCADS application

Start the `run_LCADS.sh` script in the `$LCADS_HOME/unix/run` directory. The LCADS application will run until it is stopped.

Each minute, the LCADS application will check for the presence of `LCA.TXT` or `LCA_CLUSTERS.TXT` files in the `$LCADS_HOME\WORK` directory. If present, the LCADS application will create two new files in the `WORK` directory, `LCA.cfg` and `LCA_CLUSTERS.cfg`. These files will be in a format that can be used by the OSPrey servers. This conversion process will also move the `LCA.TXT` and `LCA_CLUSTERS.TXT` files to the `$LCADS_HOME\ARCHIVE` directory and add a time stamp prefix to each `.TXT` file name.

The LCADS application will then replicate the two `.cfg` files, via an HTTP connection, from the primary LCADS application to all other OSPrey servers. The OSPrey server IP addresses must be configured using the NexusServers parameter in the `$LCADS_HOME/etc/LCADS.etc` file. The replicated files will be read into memory and also stored in the `$OSPrey_HOME/etc` directory. As part of the replication process, the `.cfg` files will be moved from `$LCADS_HOME/WORK` to the `$LCADS_HOME\ARCHIVE` directory on the LCADS server and a time stamp prefix will be added to the file name of each `.cfg` file.

Use the `stop_LCADS.sh` script in the `$LCADS_HOME/unix/run` directory to stop the LCADS application.

Least Cost Routing with Local Calls

When LCADS identifies a local call, the OSPrey routing engine temporarily prepends a ### prefix to the called number to indicate the call is local. Least cost routing with local call routing is an extension of the least cost routing model for inter-state and intra-state calls. Intra-state calls are identified by a ## prefix to the called number. Local calls are identified with a ### prefix to the called number. Perform the following steps to add local calls to the least cost routing table.

1. Provision local calling rate plans from your provider with a ### prefix added to the rate plan breakout codes. Make certain the provider account name and effective date of the local rate plan are identical to the current inter-state and intra-state rate plans provisioned to NexOSS. This detail is required so the local rates gets added to the existing provider rate plan table in NexOSS. If the effective date is different, it will be provisioned as a new rate plan and will not include the existing inter-state and intra-state rates.
2. It is possible for intra-state rates to be less than rates for local calls. To benefit from this price discrepancy, provision the intra-state rates from each provider, who does not offer a

local rate plan, as local rates. This step is simple, leave the existing intra-state rates unchanged, but provision the intra-state rates a second time with a ### prefix before the breakout codes.

3. Add breakouts, with a ### prefix to all products so the products include routes for local calls. If this step is omitted, local calls will fail with the error 404 – No Route Found.

Routing Algorithm with Local Call Routing

1. OSPrey searches DID routing table. If the called number matches an entry in the DID table, select the destinations for routing and stop search. If no match is found, continue to step 2.
2. Search direct peering table. If the called number matches one or more entries, start building a list of destinations. Continue to step 3.
3. Search the number portability database to find a match for the called number. If a match is found, use the Location Routing Number (LRN) as the routing number. If no LRN is found, the called telephone number will be the routing number.
4. Search the LCADS data, using the calling telephone number and routing number, to determine if the call is local. If the call is local, temporarily add a ### prefix to the routing number to identify the call as a local call. (See following example of how a local is identified.)
5. Perform Routing Number Translation. If the call is not local, number translation will add a ## prefix to the routing number for intra-state calls. If the call is local, the ### prefix will remain unchanged unless translation rules are explicitly added to translate routing numbers beginning with ###.
6. Perform LCR look-up. The LCR table for local calls will have breakouts with ### prefixes. The ### prefix to the routing number is removed after the LCR lookup is complete. If routes are found, they will be added to the list of destinations found in step 2 and returned to the SBC in a SIP 300 Redirect message.

Example: Logic to identify a local call

For a call
From: 240264xxxx
To: 202201xxxx

Search the LCA.TXT data to find:
Original Cluster: 0000006815
CP_BUS: 02
Terminating Cluster:0000007150

The LCA_CLUSTERS.TXT has a line that includes
0000006815020000007150
This is a local call since the ORIG_CLUST, CPNUM and TERM_CLUST values all match the data found in the LCA.TXT data. Add ### prefix to the called number used for routing. The number used for routing will be the LRN if it exists of the called telephone number if no LRN is found.

OSPrey CDRs Fields

The following OSPrey CDR fields are populated from the LCADS database look-up.

Column	Name	Description
184	Call Type	For CDRs from Oracle Acme Packet SBC: 0 if query to LCADS database indicates the call is local, otherwise 999

198	Orig_Cluster	LCADS cluster for the originating NPANXX
199	Term_Cluster	LCADS cluster for the terminating NPANXX
200	CP_BUS	CP_BUS value from a lookup to the LCA.TXT file for the originating NPA-NXX
201	SWITCH_CLLI	Common Language Location Identifier (CLLI) code of the local switch from LCADS database
203	Called Number after LCADS	The called number after the LCADS lookup will have a ### prefix if the call is local.