

CUSP Configuration Example

TAC

Document ID: 116252

Contributed by Ajeet Singh, Cisco TAC Engineer.

Aug 06, 2013

Contents

Introduction

Prerequisites

Requirements

Components Used

Configure

Scenario 1

Scenario 2

Scenario 3

Scenario 4

Configuration for All Four Scenarios

Verify

Troubleshoot

Related Information

Introduction

This document describes the sample CLI and GUI configuration of Cisco Unified SIP Proxy (CUSP) with debugs that match four different call routing scenarios.

Prerequisites

Requirements

Cisco recommends that you have basic knowledge of these topics:

- Session Initiation Protocol (SIP)
- Cisco Unified SIP Proxy (CUSP)

Components Used

The information in this document is based on CUSP.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Configure

This section describes the configuration of four call routing scenarios.

Note: Use the Command Lookup Tool (registered customers only) in order to obtain more information on the commands used in this section.

Scenario 1

Call Flow: **IP Phone 1 -- CME -- SIP -- CUSP -- SIP -- CUCM -- IP Phone 2**

Dial 408 202 2102 from IP Phone 1 registered to CallManager Express (CME) in order to reach IP Phone 2 registered to Cisco Unified Communications Manager (CUCM) via CUSP.

CME acts as a Public Switched Telephone Network (PSTN) in this scenario.

1. The SIP INVITE comes to CUSP from CME.

```
[DsTransportListener-2] DEBUG 2013.02.27 19:15:59:245 DsSipLlApi.Wire -
Received UDP packet on 14.128.100.169:5060 ,source 14.128.100.150:57878
INVITE sip:4082022102@14.128.100.169:5060 SIP/2.0
Via: SIP/2.0/UDP 14.128.100.150:5060;branch=z9hG4bK21F2555
Remote-Party-ID: "4082025555" <sip:4082025555@14.128.100.150>;
party=calling;screen=yes;privacy=off
From: "4082025555" <sip:4082025555@14.128.100.150>;tag=81D7430C-1D2
To: <sip:4082022102@14.128.100.169>
Date: Wed, 27 Feb 2013 19:15:59 GMT
Call-ID: F3E5F396-804811E2-9818EC62-1B7185EE@14.128.100.150
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 4091813662-2152206818-2551376994-0460424686
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Timestamp: 1361992559
Contact: <sip:4082025555@14.128.100.150:5060>
Expires: 180
Allow-Events: telephone-event
Max-Forwards: 69
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 410

v=0
o=CiscoSystemsSIP-GW-UserAgent 1007 629 IN IP4 14.128.100.150
s=SIP Call
c=IN IP4 14.128.100.150
t=0 0
m=audio 16930 RTP/AVP 18 101
c=IN IP4 14.128.100.150
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
m=video 17954 RTP/AVP 97
c=IN IP4 14.128.100.150
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0

--- end of packet ---
```

2. The call is accepted to the network (Net-PSTN) configuration that matches.

CLI

```

sip listen Net-PSTN udp 14.128.100.169 5060

!
sip network Net-PSTN standard
  no non-invite-provisional
  allow-connections
  retransmit-count invite-client-transaction 3
  retransmit-count invite-server-transaction 5
  retransmit-count non-invite-client-transaction 3
  retransmit-timer T1 500
  retransmit-timer T2 4000
  retransmit-timer T4 5000
  retransmit-timer TU1 5000
  retransmit-timer TU2 32000
  retransmit-timer clientTn 64000
  retransmit-timer serverTn 64000
  tcp connection-setup-timeout 1000
  udp max-datatype-size 1500
end network
!
```

GUI

	Port	Transport
14.128.100.169	5060	UDP

DEBUG

```

[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250
conditions.RegexCondition - inNetwork='Net-PSTN'
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250
conditions.RegexCondition - IN_NETWORK: Net-PSTN

```

3. The Pre-Normalization sequence is executed.

CLI

```

trigger pre-normalization sequence 1 policy CUCM-Prefix-408
condition TC-from-CUCM

```

GUI

Normalisation Policy Name	Trigger Condition Name
CUCM-Prefix-408	TC-from-CUCM

DEBUG

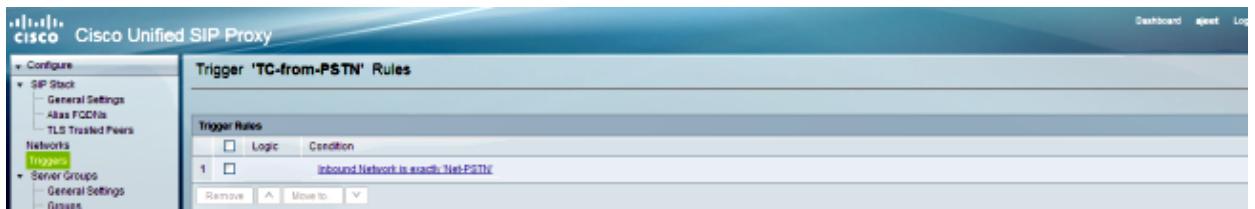
```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 util.Normalization -
Entering Normalization(moduleRequest:pre-normalize)
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 conditions.RegexCondition -
inNetwork='Net-PSTN'
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 conditions.RegexCondition -
IN_NETWORK: Net-PSTN
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 conditions.AbstractRegexCondition -
pattern(^QNet-CUCM$), toMatch(Net-PSTN) returning false
[REQUESTI.12] INFO 2013.02.27 19:15:59:250 util.Normalization -
skipping pre-normalize, due to either no trigger is configured or triggers
did not evaluate to true or is configured to by-pass
```

4. The Trigger Condition (TC-from-PSTN) is matched.

CLI

```
!
trigger condition TC-from-PSTN
sequence 1
  in-network ^QNet-PSTN$
  end sequence
end trigger condition
!
```

GUI



DEBUG

```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 conditions.RegexCondition -
inNetwork='Net-PSTN'
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 conditions.RegexCondition -
IN_NETWORK: Net-PSTN
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:250 conditions.AbstractRegexCondition -
pattern(^QNet-PSTN$), toMatch(Net-PSTN) returning true
```

5. The Routing Trigger configuration is checked in order to find the Route Policy (Policy-to-CUCM) that matches based on the Trigger Condition (TC-from-PSTN).

CLI

```
trigger routing sequence 1 policy Policy-to-CUCM condition TC-from-PSTN
```

GUI

DEBUG

```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 triggers.ModuleTrigger -
ModuleTrigger.eval() action<Policy-to-CUCM> actionParameter<>
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 triggers.ModuleTrigger -
ModuleTrigger.eval() got the policy, executing it ...
```

6. The Route Policy (Policy-to-CUCM) configuration is checked in order to find the Route Table (RT-CUCM) that matches.

CLI

```
!
policy lookup Policy-to-CUCM
sequence 100 RT-CUCM request-uri uri-component user
  modify-key 4082022102 1111
  rule exact
  end sequence
end policy
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has a tree view with 'Route Policies' selected. The main area is titled 'Route Policy Step' and shows a 'Route Table' configuration. It includes fields for 'Name' (RT-CUCM), 'Lookup Key Matches' (Exactly), 'Case Sensitive' (Disabled), and 'Candidate Value' (RT-CUCM). Below this is a 'Route Table Lookup Key' section with 'Lookup Key' (Request URI: User) and dropdowns for 'Request URI' and 'User'. Under 'Lookup Key Modifiers', there are four entries: 'Regular Expression Match' (4082022102), 'Regular Expression Replace' (1111), 'Remove leading '+' symbol' (Disabled), and 'Remove separator characters' (Disabled). At the bottom are 'Update' and 'Cancel' buttons.

DEBUG

```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.XCLPrefix -
Entering getKeyValue()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.FieldSelector -
getUriPart: URI - sip:4082022102@14.128.100.169:5060 part 6
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.FieldSelector -
Requested field 45
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.FieldSelector -
Returning key 4082022102
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.FieldSelector -
Retrieved Modifier RegexModifier: match= 4082022102, replace=
1111, ignore case= false
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.FieldSelector -
Input field: 4082022102
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:251 nrs.FieldSelector -
Modified field: 1111
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 nrs.XCLPrefix -
Leaving getKeyValue()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 modules.XCLLookup -
table=RT-CUCM, key=1111
[REQUESTI.12] INFO 2013.02.27 19:15:59:252 modules.XCLLookup -
table is RT-CUCM
```

7. The Route Table (RT-CUCM) configuration is checked in order to find the Target Destination (SG-CUCM.ajeet.com).

CLI

```
!
route table RT-CUCM
key 1111 target-destination SG-CUCM.ajeet.com Net-CUCM
end route table
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has a tree view with 'Route Tables' selected. The main area is titled 'Route Table 'RT-CUCM' Routes' and shows a table of routes. There is one active route entry: Key 1111, Target Destination SG-CUCM.ajeet.com, and Network Net-CUCM. At the bottom, there is a note explaining record states: New (New record, will be added to active configuration when committed), Modified (Modified record, will become active configuration when committed), Deleted (Deleted record, will be removed from active configuration when committed), and Active (Active record, active configuration).



DEBUG

```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 routingtables.RoutingTable -
Entering lookup()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 routingtables.RoutingTable -
Looking up 1111 in table RT-CUCM with rule exact and modifiers=none
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 routingtables.RoutingTable -
Entering applyModifiers()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 routingtables.RoutingTable -
Leaving applyModifiers(), returning 1111
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 routingtables.RoutingTable -
Leaving lookup()
[REQUESTI.12] INFO 2013.02.27 19:15:59:252 nrs.XCLPrefix -
NRS Routing decision is: RouteTable:RT-CUCM, RouteKey:1111,
TargetDestination:SG-CUCM.ajeet.com, Network:Net-CUCM
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.12] INFO 2013.02.27 19:15:59:252 loadbalancer.LBFactory -
lbtype is 3(call-id)
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 nrs.XCLPrefix -
Stored NRSAlgResult=isFound=true, isFailure=false, Response=-1,
Routes=[Ruri: SG-CUCM.ajeet.com, Route: null, Network: Net-CUCM,
q-value=1.0,advance=[502, 503]], PolicyAdvance=null
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 nrs.NRSAlgResult -
set policyAdvance as specified in route=RouteTable:RT-CUCM, RouteKey:1111,
TargetDestination:SG-CUCM.ajeet.com, Network:Net-CUCM
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:252 nrs.NRSAlgResult -
no policyAdvance specified in route
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:253 nrs.NRSAlgResult -
set policyAdvance as specified in algorithm={lookupkeymodifier=
[ RegexModifier: match= 4082022102, replace= 1111, ignore case= false],
lookuprule=0, lookupfield=45, lookuplength=-1, lookuptable=RT-CUCM,
sequence=100, algorithm=1}
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:253 nrs.NRSAlgResult -
no policyAdvance specified in algorithm
```

8. The Post-Normalization Sequence is executed.

Note: This scenario does not use Post-Normalization, which is why Post-Normalization is skipped in the debugs.

CLI

```
trigger post-normalization sequence 1 policy  
UC520-Four-to-Full condition TC-UC520-to-PSTN
```

GUI

DEBUG

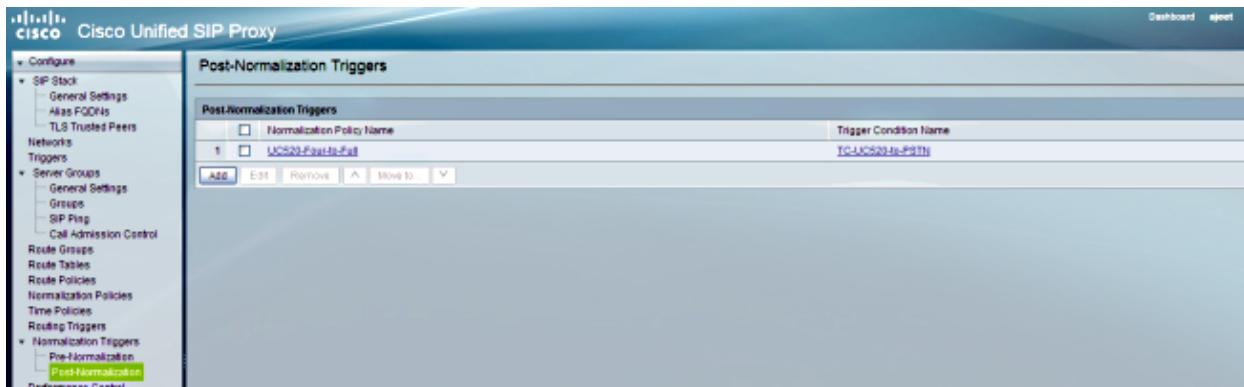
```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 util.Normalization -  
Entering Normalization(moduleRequest:post-normalize)  
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 conditions.RegexCondition -  
inNetwork='Net-PSTN'  
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 conditions.RegexCondition -  
IN_NETWORK: Net-PSTN  
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 conditions.AbstractRegexCondition -  
pattern(^QNet-From-UC520\E$), toMatch(Net-PSTN) returning false  
[REQUESTI.12] INFO 2013.02.27 19:15:59:254 util.Normalization -  
skipping post-normalize, due to either no trigger is configured or triggers  
did not evaluate to true or is configured to by-pass
```

9. The Server Group configuration is checked in order to find the element IP address, and the call is routed to the best route possible based on the Q-value and Weight configuration.

CLI

```
!  
server-group sip group SG-CUCM.ajeet.com Net-CUCM  
element ip-address 14.128.64.191 5060 udp q-value 1 weight 50  
element ip-address 14.128.64.192 5060 udp q-value 1.0 weight 100  
failover-resp-codes 503  
lbtype global  
ping  
end server-group  
!
```

GUI



DEBUG

```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.12] INFO 2013.02.27 19:15:59:254 loadbalancer.LBFactory -
lbtype is 0(global)
[REQUESTI.12] INFO 2013.02.27 19:15:59:254 loadbalancer.LBFactory -
Default lbtype is 3(call-id)
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 loadbalancer.LBBase -
Entering getServer()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 loadbalancer.LBBase -
Entering initializeDomains()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 servergroups.
ServerGlobalStateWrapper - Net-CUCM:14.128.64.191:5060:1
numTries=2-->isServerAvailable(): true
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:254 servergroups.
ServerGlobalStateWrapper - Net-CUCM:14.128.64.192:5060:1
numTries=2-->isServerAvailable(): true
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 servergroups.AbstractNextHop -
Entering compareDomainNames()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 servergroups.AbstractNextHop -
Leaving compareDomainNames()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 loadbalancer.LBBase -
Leaving initializeDomains()
[REQUESTI.12] INFO 2013.02.27 19:15:59:255 loadbalancer.LBHashBased -
list of elements in order on which load balancing is done :
{reSgElementWeight=50, reSgElementSgName=SG-CUCM.ajeet.com,
reSgElementTransport=UDP, reSgElementQValue=1.0, reSgElementPort=5060,
reSgElementHost=14.128.64.191}, {reSgElementWeight=100, reSgElementSgName=
SG-CUCM.ajeet.com, reSgElementTransport=UDP, reSgElementQValue=1.0,
reSgElementPort=5060, reSgElementHost=14.128.64.192},
[REQUESTI.12] INFO 2013.02.27 19:15:59:255 loadbalancer.LBHashBased -
Hashing on F3E5F396-804811E2-9818EC62-1B7185EE@14.128.100.150
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 loadbalancer.DsHashAlgorithm -
Entering selectIndex()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 loadbalancer.DsHashAlgorithm -
Leaving selectIndex()
[REQUESTI.12] INFO 2013.02.27 19:15:59:255 loadbalancer.LBHashBased -
Index selected 0
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 servergroups.AbstractNextHop -
Entering compareDomainNames()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 servergroups.AbstractNextHop -
Leaving compareDomainNames()
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 loadbalancer.LBBase -
Server group SG-CUCM.ajeet.com selected {reSgElementWeight=50,
reSgElementSgName=SG-CUCM.ajeet.com, reSgElementTransport=UDP,
reSgElementQValue=1.0, reSgElementPort=5060, reSgElementHost=14.128.64.191}
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:255 loadbalancer.LBBase -
```

```
Leaving getServer()
```

10. The SIP INVITE is sent to the selected element.

```
[REQUESTI.12] DEBUG 2013.02.27 19:15:59:256 DsSipLlApi.Wire -
Sending UDP packet on 14.128.100.169:32771, destination 14.128.64.191:5060
INVITE sip:4082022102@SG-CUCM.ajeet.com SIP/2.0
Via: SIP/2.0/UDP 14.128.100.169:5061;branch=z9hG4bK.ToYJFeKMyfZGySv.gcLjg~~231
Via: SIP/2.0/UDP 14.128.100.150:5060;branch=z9hG4bK21F2555
Max-Forwards: 68
To: <sip:4082022102@14.128.100.169>
From: "4082025555" <sip:4082025555@14.128.100.150>;tag=81D7430C-1D2
Contact: <sip:4082025555@14.128.100.150:5060>
Expires: 180
Remote-Party-ID: "4082025555" <sip:4082025555@14.128.100.150
>;party=calling;screen=yes;privacy=off
Call-ID: F3E5F396-804811E2-9818EC62-1B7185EE@14.128.100.150
CSeq: 101 INVITE
Content-Length: 410
Date: Wed, 27 Feb 2013 19:15:59 GMT
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 4091813662-2152206818-2551376994-0460424686
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
Timestamp: 1361992559
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
o=CiscoSystemsSIP-GW-UserAgent 1007 629 IN IP4 14.128.100.150
s=SIP Call
c=IN IP4 14.128.100.150
t=0 0
m=audio 16930 RTP/AVP 18 101
c=IN IP4 14.128.100.150
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
m=video 17954 RTP/AVP 97
c=IN IP4 14.128.100.150
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
```

Note: Some devices, such as CUCM, validate the Uniform Resource Identifier (URI) of requests before they process them, which means that the end device might need to be configured with the Fully Qualified Domain Name (FQDN) in order to allow for this.

In the case of CUCM, **CUCM > System > Enterprise Parameter > Clusterwide Domain Configuration > Cluster Fully Qualified Domain Name** should be the same as the server group name.



Scenario 2

Call Flow: **IP Phone 1 -- CUCM -- SIP -- CUSP -- SIP -- CME -- IP Phone 2**

Dial 202 2222 from IP Phone 2. 408 should be prefixed with Pre-Normalization in order to reach IP Phone 1.

CME acts as PSTN in this scenario.

1. The SIP INVITE comes to CUSP from CUCM.

```
[DsTransportListener-0] DEBUG 2013.02.28 00:34:03:370 DsSipLlApi.Wire -
Received UDP packet on 14.128.100.169:5061 ,source 14.128.64.192:5060
INVITE sip:2022222@14.128.100.169:5061 SIP/2.0
Via: SIP/2.0/UDP 14.128.64.192:5060;branch=z9hG4bK18012ae333f
From: "SJ Phone 1" <sip:2001@14.128.64.192>;
tag=534264~c1b77ee1-4af9-4a41-aed3-3846cd699427-49616146
To: <sip:2022222@14.128.100.169>
Date: Thu, 28 Feb 2013 00:34:03 GMT
Call-ID: 8be55500-12e1a5fb-ab-c040800e@14.128.64.192
Supported: timer,resource-priority,replaces
Min-SE: 1800
User-Agent: Cisco-CUCM8.6
Allow: INVITE, OPTIONS, INFO, BYE, CANCEL, ACK, PRACK, UPDATE,
REFER, SUBSCRIBE, NOTIFY
CSeq: 101 INVITE
Expires: 180
Allow-Events: presence, kpml
Supported: X-cisco-srtp-fallback,X-cisco-original-called
Call-Info: <sip:14.128.64.192:5060>
;method="NOTIFY;Event=telephone-event;Duration=500"
Cisco-Guid: 2347062528-0000065536-0000000107-3225452558
Session-Expires: 1800
P-Asserted-Identity: "SJ Phone 1" <sip:2001@14.128.64.192>
Remote-Party-ID: "SJ Phone 1" <sip:2001@14.128.64.192>
;party=calling;screen=yes;privacy=off
Contact: <sip:2001@14.128.64.192:5060>
Max-Forwards: 70
Content-Length: 0

--- end of packet ---
```

2. The call is accepted on the network (Net-CUCM) configuration that matches.

CLI

```
sip listen Net-CUCM udp 14.128.100.169 5061

!
sip network Net-CUCM standard
no non-invite-provisional
allow-connections
retransmit-count invite-client-transaction 3
retransmit-count invite-server-transaction 5
retransmit-count non-invite-client-transaction 3
retransmit-timer T1 500
retransmit-timer T2 4000
retransmit-timer T4 5000
retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has sections like Configure, SIP Stack, Server Groups, and Networks. Under Networks, 'Triggers' is highlighted. The main area is titled 'Network: "Net-CUCM"' with tabs for General Settings, SIP Reparameters, SIP Listen Points (which is selected), and SIP Record-Route. Under 'SIP Listen Points', there are two entries:

IP Address	Port	Transport
192.168.100.169	5061	udp

Buttons at the bottom include Add, Remove, and Page.

DEBUG

```
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:373 conditions.RegexCondition -  
inNetwork='Net-CUCM'  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:373 conditions.RegexCondition -  
IN_NETWORK: Net-CUCM
```

3. The Pre-Normalization sequence is executed.

CLI

```
trigger pre-normalization sequence 1 policy CUCM-Prefix-408  
condition TC-from-CUCM
```

```
!  
policy normalization CUCM-Prefix-408  
uri-component update request-uri user 2022222 4082022222  
end policy  
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has sections like Configure, SIP Stack, Server Groups, and Networks. Under Networks, 'Triggers' is highlighted. The main area is titled 'Pre-Normalization Triggers' with a table:

Normalization Policy Name	Trigger Condition Name
CUCM-Prefix-408	TC-from-CUCM

Buttons at the bottom include Add, Edit, Remove, and Move to.

DEBUG

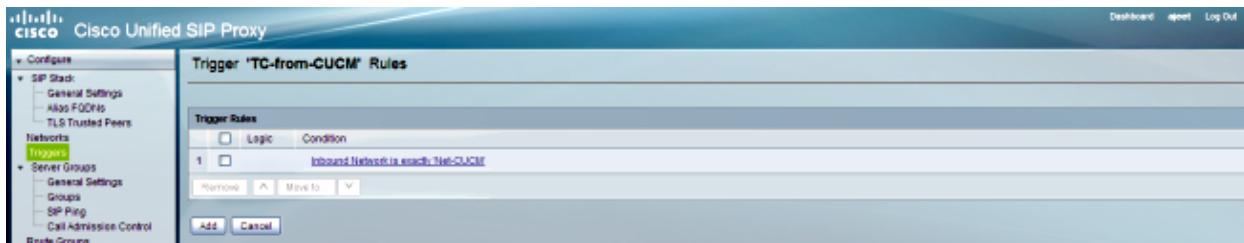
```
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:373 util.Normalization -
Entering Normalization(moduleRequest:pre-normalize
)[REQUESTI.12] DEBUG 2013.02.28 00:34:03:373 conditions.RegexCondition -
inNetwork='Net-CUCM'
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:373 conditions.RegexCondition -
IN_NETWORK: Net-CUCM
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.AbstractRegexCondition -
pattern(^QNet-CUCM$), toMatch(Net-CUCM) returning true
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 triggers.ModuleTrigger -
ModuleTrigger.eval() action<CUCM-Prefix-408> actionParameter<>
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 triggers.ModuleTrigger -
ModuleTrigger.eval() got the policy, executing it ...
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 normalization.
URIComponentNormalizationAlgorithm - normalizing request-uri
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 normalization.
URIComponentNormalizationAlgorithm -
updating user/phone of the sip:2022222@14.128.100.169:5061 to 4082022222
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 util.Normalization -
Leaving Normalization.normalize()
```

4. The Trigger Condition (TC-from-CUCM) is matched.

CLI

```
!
trigger condition TC-from-CUCM
sequence 1
  in-network ^QNet-CUCM$
  end sequence
end trigger condition
!
```

GUI



DEBUG

```
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.RegexCondition -  
inNetwork='Net-CUCM'  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.RegexCondition -  
IN_NETWORK: Net-CUCM  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.AbstractRegexCondition -  
pattern(^QNet-CUCM$), toMatch(Net-CUCM) returning true
```

5. The Routing Trigger configuration is checked in order to discover the Route Policy (Policy-to-PSTN) that matches based on the Trigger Condition (TC-from-CUCM).

CLI

```
trigger routing sequence 2 policy Policy-to-PSTN condition TC-from-CUCM
```

GUI



DEBUG

```
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.RegexCondition -  
inNetwork='Net-CUCM'  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.RegexCondition -  
IN_NETWORK: Net-CUCM  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:374 conditions.AbstractRegexCondition -  
pattern(^QNet-CUCM$), toMatch(Net-CUCM) returning true  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 triggers.ModuleTrigger -  
ModuleTrigger.eval() action<Policy-to-PSTN> actionParameter<>  
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 triggers.ModuleTrigger -  
ModuleTrigger.eval() got the policy, executing it ...
```

6. The Route Policy (Policy-to-PSTN) configuration is checked in order to find the Route Table (RT-PSTN) that matches.

CLI

```
!
policy lookup Policy-to-PSTN
sequence 100 RT-PSTN request-uri uri-component user
```

```

rule exact
end sequence
end policy
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar navigation menu includes: Configure, SIP Stack (General Settings, Alias FQDNs, TLS Trusted Peers), Networks, Triggers, Server Groups (General Settings, Groups, SIP Ping, Call Admission Control), Route Groups, Route Tables, Route Policies (highlighted in green), and Normalization Policies. The main content area is titled "Route Policy 'Policy-to-PSTN' Steps". It displays a table of route steps:

Step	Key	Lookup Rule	Route Table
1	RequestURI>User	Exactly	RT-PSTN

Below the table is a status bar with the message: "New : New record; will be added to active configuration when committed." Other status indicators include: Modified, Deleted, and Active.

This screenshot shows the detailed configuration for a specific route step. The left sidebar navigation menu is identical to the previous one. The main content area is titled "Route Policy Step". It shows the configuration for the first step in the route table:

Route Table	Active Value	Candidate Value
Name:	RT-PSTN	RT-PSTN
Lookup Key Matches:	Exactly	Exactly
Case Sensitive:	Disabled	<input type="checkbox"/>

Below this are sections for "Route Table Lookup Key" and "Lookup Key Modifiers". The "Route Table Lookup Key" section includes fields for "Lookup Key" (RequestURI>User) and dropdowns for "Request URI" and "User". The "Lookup Key Modifiers" section contains several checkboxes for "Regular Expression Match", "Regular Expression Replace", "Remove leading <> symbol", and "Remove separator characters". At the bottom are "Update" and "Cancel" buttons.

DEBUG

```

[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 nrs.XCLPrefix -
Entering getKeyValue()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 nrs.FieldSelector -
getUriPart: URI - sip:4082022222@14.128.100.169:5061 part 6
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 nrs.FieldSelector -
Requested field 45
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 nrs.FieldSelector -
Returning key 4082022222
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 nrs.XCLPrefix -
Leaving getKeyValue()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:375 modules.XCLLookup -
table=RT-PSTN, key=4082022222
[REQUESTI.12] INFO 2013.02.28 00:34:03:376 modules.XCLLookup -
table is RT-PSTN
```

7. The Route Table (RT-PSTN) configuration is checked in order to find the Target Destination (SG-PSTN).

CLI

```

!
route table RT-PSTN
key 4082022222 target-destination SG-PSTN Net-PSTN
end route table
```

GUI

DEBUG

```
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 routingtables.RoutingTable -
Entering lookup()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 routingtables.RoutingTable -
Looking up 4082022222 in table RT-PSTN with rule exact and modifiers=none
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 routingtables.RoutingTable -
Entering applyModifiers()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 routingtables.RoutingTable -
Leaving applyModifiers(), returning 4082022222
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 routingtables.RoutingTable -
Leaving lookup()
[REQUESTI.12] INFO 2013.02.28 00:34:03:376 nrs.XCLPrefix -
NRS Routing decision is: RouteTable:RT-PSTN, RouteKey:4082022222,
TargetDestination:SG-PSTN, Network:Net-PSTN
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.12] INFO 2013.02.28 00:34:03:376 loadbalancer.LBFactory -
lbtype is 3(call-id)
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 nrs.XCLPrefix -
Stored NRSAlgResult=isFound=true, isFailure=false, Response=-1,
Routes=[Ruri: SG-PSTN, Route: null, Network: Net-PSTN, q-value=1.
0radvance=[502, 503]], PolicyAdvance=null
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 nrs.NRSAlgResult -
```

```

set policyAdvance as specified in route=RouteTable:RT-PSTN, RouteKey:4082022222,
TargetDestination:SG-PSTN, Network:Net-PSTN
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 nrs.NRSAlgResult -
no policyAdvance specified in route
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 nrs.NRSAlgResult -
set policyAdvance as specified in algorithm={lookuprule=0, lookupfield=45,
lookuplength=-1, lookuptable=RT-PSTN, sequence=100, algorithm=1}
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:376 nrs.NRSAlgResult -
no policyAdvance specified in algorithm

```

8. The Post-Normalization Sequence is executed.

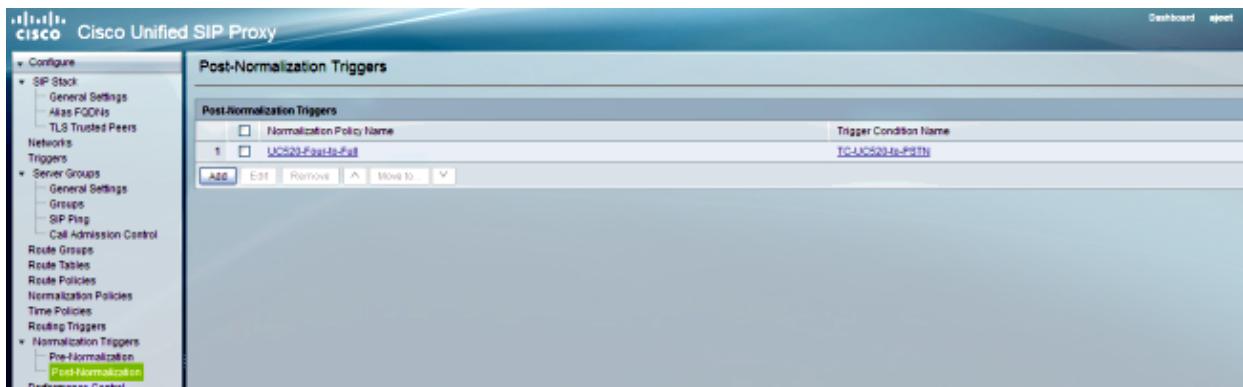
CLI

```

trigger post-normalization sequence 1 policy UC520-Four-to-Full
condition TC-UC520-to-PSTN
!

```

GUI



DEBUG

```

[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 util.Normalization -
Entering Normalization(moduleRequest:post-normalize)
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 conditions.RegexCondition -
inNetwork='Net-CUCM'
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 conditions.RegexCondition -
IN_NETWORK: Net-CUCM
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 conditions.AbstractRegexCondition -
pattern(^\\QNet-From-UC520\\E$), toMatch(Net-CUCM) returning false
[REQUESTI.12] INFO 2013.02.28 00:34:03:378 util.Normalization -
skipping post-normalize, due to either no trigger is configured or triggers
did not evaluate to true or is configured to by-pass

```

9. The Server Group (SG-PSTN) configuration is checked in order to find the element IP address, and the call is routed to the best route possible based on the Q-value and Weight configuration.

CLI

```

!
server-group sip group SG-PSTN Net-PSTN
element ip-address 14.128.100.150 5060 udp q-value 1.0 weight 0
failover-resp-codes 503
lbttype global
ping
end server-group
!
```

GUI

State	IP Address	Port	Transport	Nested Server Group	Q-value	Weight	
<input type="checkbox"/>	Active	14.128.100.150	5060	UDP	-	1.0	0

DEBUG

```
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.12] INFO 2013.02.28 00:34:03:378 loadbalancer.LBFactory -
lbtype is 0(global)
[REQUESTI.12] INFO 2013.02.28 00:34:03:378 loadbalancer.LBFactory -
Default lbtype is 3(call-id)
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 loadbalancer.LBBBase -
Entering getServer()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 loadbalancer.LBBBase -
Entering initializeDomains()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 servergroups.
ServerGlobalStateWrapper - Net-PSTN:14.128.100.150:5060:1 numTries=
2-->isServerAvailable(): true
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 loadbalancer.LBBBase -
Leaving initializeDomains()
[REQUESTI.12] INFO 2013.02.28 00:34:03:378 loadbalancer.LBHashBased -
list of elements in order on which load balancing is done :
{reSgElementWeight=0, reSgElementSgName=SG-PSTN, reSgElementTransport=UDP,
reSgElementQValue=1.0, reSgElementPort=5060, reSgElementHost=14.128.100.150}
, [REQUESTI.12] DEBUG 2013.02.28 00:34:03:378 servergroups.AbstractNextHop -
Entering compareDomainNames()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:379 servergroups.AbstractNextHop -
Leaving compareDomainNames()
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:379 loadbalancer.LBBBase -
Server group SG-PSTN selected {reSgElementWeight=0, reSgElementSgName=SG-PSTN,
reSgElementTransport=UDP, reSgElementQValue=1.0, reSgElementPort=5060,
reSgElementHost=14.128.100.150}
[REQUESTI.12] DEBUG 2013.02.28 00:34:03:379 loadbalancer.LBBBase -
Leaving getServer()
```

10. The SIP INVITE is sent to the selected element.

```
[CT_CALLBACK.13] DEBUG 2013.02.28 00:34:06:260 DsSipLlApi.Wire -
Sending UDP packet on 14.128.100.169:32772, destination 14.128.64.192:
5060SIP/2.0 200 OK
Via: SIP/2.0/UDP 14.128.64.192:5060;branch=z9hG4bK18012ae333f
To: <sip:2022222@14.128.100.169>;tag=82FA7450-F53
From: "SJ Phone 1" <sip:2001@14.128.64.192>
;tag=534264-c1b77eef-4af9-4a41-aed3-3846cd699427-49616146
Contact: <sip:4082022222@14.128.100.150:5060>
Require: timer
Remote-Party-ID: <sip:4082022222@14.128.100.150>
;party=called;screen=no;privacy=off
Call-ID: 8be55500-12ela5fb-ab-c040800e@14.128.64.192
CSeq: 101 INVITE
Content-Length: 276
Date: Thu, 28 Feb 2013 00:34:03 GMT
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
```

```

Allow-Events: telephone-event
Supported: replaces
Supported: sdp-anat
Supported: timer
Server: Cisco-SIPGateway/IOS-12.x
Session-Expires: 1800;refresher=uac
Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
o=CiscoSystemsSIP-GW-UserAgent 6810 2753 IN IP4 14.128.100.150
s=SIP Call
c=IN IP4 14.128.100.150
t=0 0
m=audio 16862 RTP/AVP 18 101
c=IN IP4 14.128.100.150
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20

```

Scenario 3

Call Flow: ***IP Phone 1 -- CME 1 -- SIP -- CUSP -- SIP -- CME 2 -- IP Phone 2***

Dial 4001 or 4002 from IP Phone 1 in order to reach extensions on IP Phone 2.

CME 2 is UC520 in this scenario and CME 1 acts as PSTN.

1. The SIP INVITE comes to CUSP from CME 1 (PSTN).

```

[DsTransportListener-3] DEBUG 2013.02.28 05:28:57:360 DsSipLlApi.Wire -
Received UDP packet on 14.128.100.169:5062 ,source 14.128.100.150:56578
INVITE sip:4002@14.128.100.169:5062 SIP/2.0
Via: SIP/2.0/UDP 14.128.100.150:5060;branch=z9hG4bK2292567
Remote-Party-ID: <sip:85224044444@14.128.100.150>
;party=calling;screen=no;privacy=off
From: <sip:85224044444@14.128.100.150>;tag=84086F7C-10B8
To: <sip:4002@14.128.100.169>
Date: Thu, 28 Feb 2013 05:28:57 GMT
Call-ID: 9559E957-809E11E2-9856EC62-1B7185EE@14.128.100.150
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 2446255913-2157842914-2555505762-0460424686
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Max-Forwards: 70
Timestamp: 1362029337
Contact: <sip:85224044444@14.128.100.150:5060>
Expires: 180
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 276

v=0
o=CiscoSystemsSIP-GW-UserAgent 3653 4016 IN IP4 14.128.100.150
s=SIP Call
c=IN IP4 14.128.100.150
t=0 0
m=audio 19202 RTP/AVP 18 101

```

```

c=IN IP4 14.128.100.150
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20

```

--- end of packet ---

2. The call is accepted on the network (Net-UC520) configuration that matches.

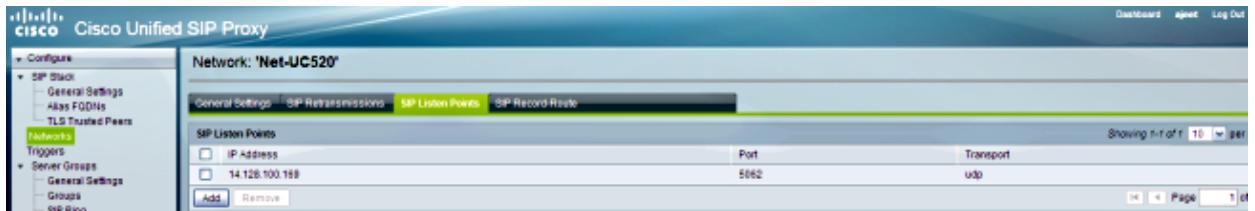
CLI

```

sip listen Net-UC520 udp 14.128.100.169 5062

!
sip network Net-From-UC520 standard
no non-invite-provisional
allow-connections
retransmit-count invite-client-transaction 3
retransmit-count invite-server-transaction 5
retransmit-count non-invite-client-transaction 3
retransmit-timer T1 500
retransmit-timer T2 4000
retransmit-timer T4 5000
retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
!
```

GUI



DEBUG

```

[REQUESTI.10] DEBUG 2013.02.28 05:28:57:362 conditions.RegexCondition -
inNetwork='Net-UC520'
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:362 conditions.RegexCondition -
IN_NETWORK: Net-UC520

```

3. The Pre-Normalization sequence is executed.

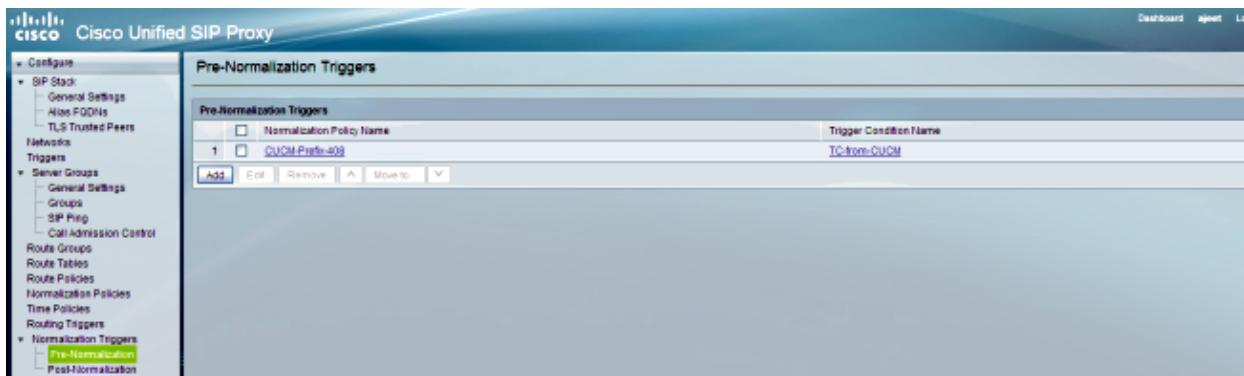
CLI

```

trigger pre-normalization sequence 1 policy CUCM-Prefix-408 condition
TC-from-CUCM

```

GUI



DEBUG

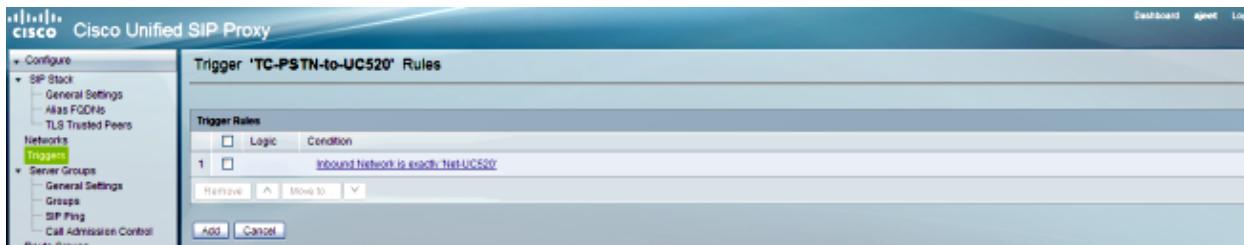
```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:362 util.Normalization -
Entering Normalization(moduleRequest:pre-normalize)
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:362 conditions.RegexCondition -
inNetwork='Net-UC520'
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:362 conditions.RegexCondition -
IN_NETWORK: Net-UC520
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:362 conditions.AbstractRegexCondition -
pattern(^QNet-UCM\E$), toMatch(Net-UC520) returning false
[REQUESTI.10] INFO 2013.02.28 05:28:57:362 util.Normalization -
skipping pre-normalize, due to either no trigger is configured or triggers
did not evaluate to true or is configured to by-pass
```

4. The Trigger Condition (TC-PSTN-to-UC520) is matched.

CLI

```
!
trigger condition TC-PSTN-to-UC520
sequence 1
  in-network ^QNet-UC520\E$
end sequence
end trigger condition
!
```

GUI



DEBUG

```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 conditions.RegexCondition -
inNetwork='Net-UC520'
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 conditions.RegexCondition -
IN_NETWORK: Net-UC520
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 conditions.AbstractRegexCondition -
pattern(^QNet-UC520\E$), toMatch(Net-UC520) returning true
```

5. The Routing Trigger configuration is checked in order to find the Route Policy (Policy-UC520) that matches based on the Trigger Condition (TC-PSTN-to-UC520).

CLI

```
trigger routing sequence 3 policy Policy-UC520 condition TC-PSTN-to-UC520
```

GUI

Trigger
1 Policy-to-CUCM TC-From-PSTN
2 Policy-to-PSTN TC-From-CUCM
3 Policy-to-UC520 TC-PSTN-to-UC520
4 Policy-UC520-to-PSTN TC-UC520-to-PSTN

DEBUG

```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 triggers.ModuleTrigger -  
ModuleTrigger.eval() action<Policy-UC520> actionParameter<>  
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 triggers.ModuleTrigger -  
ModuleTrigger.eval() got the policy, executing it ...
```

6. The Route Policy (Policy-UC520) configuration is checked in order to find the Route Table (RT-UC520) that matches.

CLI

```
!  
policy lookup Policy-UC520  
sequence 100 RT-UC520 request-uri uri-component user  
modify-key 400[12] 2222  
rule exact  
end sequence  
end policy  
!
```

GUI

Route Table
RT-UC520

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar is titled 'Configure' and lists various sections: SIP Stack, General Settings, Alias FQDNs, TLS Trusted Peers, Networks, Triggers, Server Groups, General Settings, Groups, SIP Ring, Call Admission Control, Route Groups, Route Tables, and Route Policies. The 'Route Policies' section is currently selected. The main panel is titled 'Route Policy Step' and displays the configuration for a 'Route Table'. It includes fields for 'Name' (RT-UC520), 'Lookup Key Matches' (Exactly), 'Case Sensitive' (Disabled), 'Route Table Lookup Key' (Request URI User), 'Lookup Key Modifiers' (Regular Expression Match: 400[12], Regular Expression Replace: 2222, Remove leading '+' symbol: Disabled, Remove separator characters: Disabled), and buttons for 'Update' and 'Cancel'.

DEBUG

```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.XCLPrefix -
Entering getKeyValue()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.FieldSelector -
getUriPart: URI - sip:4002@14.128.100.169:5062 part 6
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.FieldSelector -
Requested field 45
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.FieldSelector -
Returning key 4002
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.FieldSelector -
Retrieved Modifier RegexModifier: match= 400[12], replace= 2222,
ignore case= false
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.FieldSelector -
Input field: 4002
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.FieldSelector -
Modified field: 2222
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 nrs.XCLPrefix -
Leaving getKeyValue()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:363 modules.XCLLookup -
table=RT-UC520, key=2222
[REQUESTI.10] INFO 2013.02.28 05:28:57:364 modules.XCLLookup -
table is RT-UC520
```

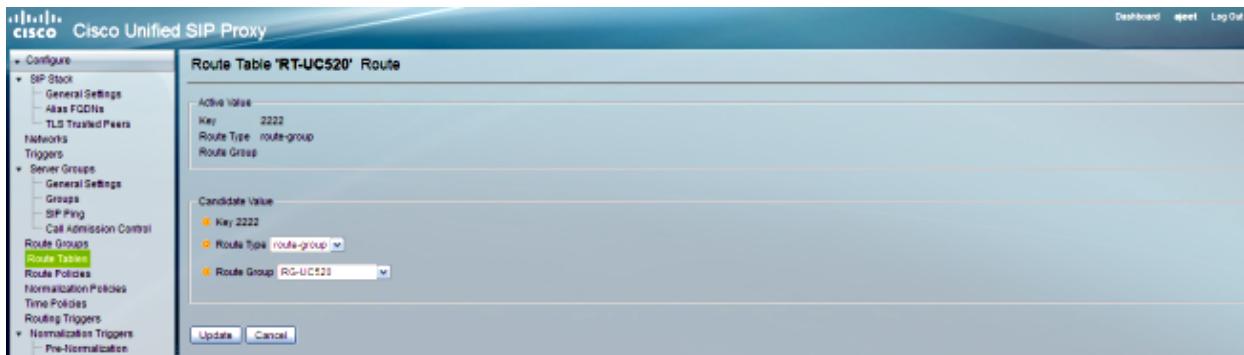
7. The Route Table (RT-UC520) configuration is checked in order to find the Target Destination (RG-UC520).

CLI

```
!
route table RT-UC520
key 2222 group RG-UC520
end route table
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar is titled 'Configure' and lists various sections: SIP Stack, General Settings, Alias FQDNs, TLS Trusted Peers, Networks, Triggers, Server Groups, General Settings, Groups, SIP Ring, Call Admission Control, Route Groups, Route Tables, and Route Policies. The 'Route Tables' section is currently selected. The main panel is titled 'Route Table 'RT-UC520' Routes' and displays a table of routes. The table has columns for State, Key, Route Group, Target Destination, Next Hop, Response, Lookup Route Policy, Default SIP Rule, and Network. One row is visible, showing 'Active' for State, '2222' for Key, 'RG-UC520' for Route Group, and '-' for Target Destination, Next Hop, Response, and Default SIP Rule. At the bottom of the table, there are buttons for 'Add', 'Remove', 'Import', and 'Export Active Routes'. A note at the bottom explains the status codes: New (New record, will be added to active configuration when committed), Modified (Modified record, will become active configuration when committed), Deleted (Deleted record, will be removed from active configuration when committed), and Active (Active record, active configuration).



DEBUG

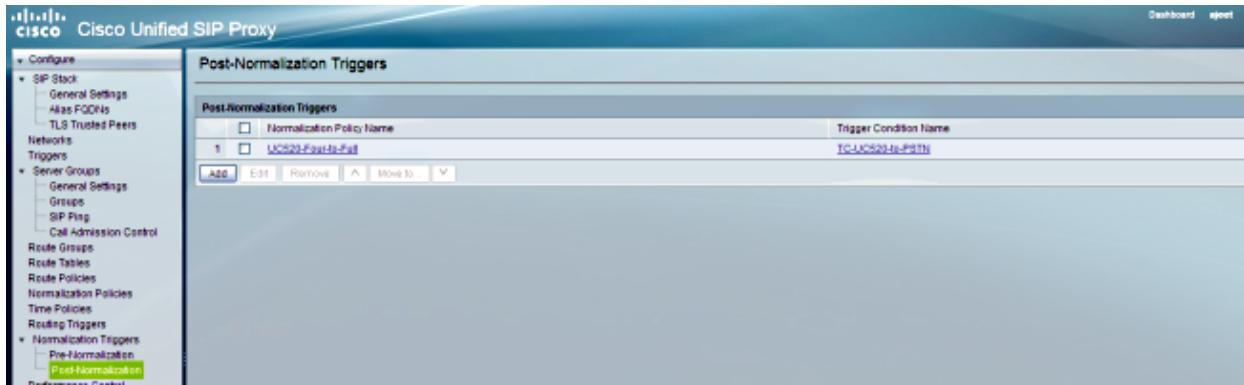
```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 routingtables.RoutingTable -
Entering lookup()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 routingtables.RoutingTable -
Looking up 2222 in table RT-UC520 with rule exact and modifiers=none
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 routingtables.RoutingTable -
Entering applyModifiers()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 routingtables.RoutingTable -
Leaving applyModifiers(), returning 2222
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 routingtables.RoutingTable -
Leaving lookup()
[REQUESTI.10] INFO 2013.02.28 05:28:57:364 nrs.XCLPrefix -
NRS Routing decision is: RouteTable:RT-UC520, RouteKey:2222, RouteGroup:RG-UC520
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.10] INFO 2013.02.28 05:28:57:364 loadbalancer.LBFactory -
lbtype is 3(call-id)
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 nrs.XCLPrefix -
Stored NRSAlgResult=isFound=true, isFailure=false, Response=-1,
Routes=[Ruri: SG-UC520, Route: null, Network: Net-UC520, q-value=1.
0radvance=[502, 503]], PolicyAdvance=null
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 nrs.NRSAlgResult -
set policyAdvance as specified in route=RouteTable:RT-UC520, RouteKey:2222,
RouteGroup:RG-UC520
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 nrs.NRSAlgResult -
no policyAdvance specified in route
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 nrs.NRSAlgResult -
set policyAdvance as specified in algorithm={lookupkeymodifier=
[RegexModifier: match= 400[12], replace= 2222, ignore case= false],
lookuprule=0, lookupfield=45, lookuptable=RT-UC520,
sequence=100, algorithm=1}
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:364 nrs.NRSAlgResult -
no policyAdvance specified in algorithm
```

8. The Post-Normalization Sequence is executed.

CLI

```
trigger post-normalization sequence 1 policy UC520-Four-to-Full
condition TC-UC520-to-PSTN
```

GUI



DEBUG

```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 util.Normalization -
Entering Normalization(moduleRequest:post-normalize)
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 conditions.RegexCondition -
inNetwork='Net-UC520'
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 conditions.RegexCondition -
IN_NETWORK: Net-UC520
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 conditions.AbstractRegexCondition -
pattern(^QNet-From-UC520\E$), toMatch(Net-UC520) returning false
[REQUESTI.10] INFO 2013.02.28 05:28:57:365 util.Normalization -
skipping post-normalize, due to either no trigger is configured or
triggers did not evaluate to true or is configured to by-pass
```

9. The Route Group configuration is checked in order to find the element IP address, and the call is routed to the best route possible based on the Q-value and Weight setting.

CLI

```
!
route group RG-UC520
  element target-destination SG-UC520 Net-UC520 q-value 1.0
    failover-codes 502 - 503
    weight 0
    end element
  end route
!

!
server-group sip group SG-UC520 Net-UC520
  element ip-address 14.128.100.161 5060 udp q-value 1.0 weight 0
    failover-resp-codes 503
    lbtype global
    ping
  end server-group
!
```

GUI

Cisco Unified SIP Proxy

Route Group 'RG-UC520'

Configure

- SIP Stack
 - General Settings
 - Alias FQDNs
 - TLS Trusted Peers
- Networks
- Triggers
- Server Groups
 - General Settings
 - Groups
 - SIP Ping
 - Call Admission Control
- Route Groups**
- Route Tables
- Route Policies
- Normalization Policies
- Time Policies
- Routing Triggers
- Normalization Triggers
 - Pre-Normalization
 - Post-Normalization
- Performance Control
- Call Admission Control
- ...

Route Group Elements

Status	Host / Server Group	Port	Transport	Nex Hop	Network	Q-Value	Weight	Time Policy	Fallback Response Codes
Active	SG-UC520	-	-	-	Net-UC520	10	0	-	{602, 603}

Notes:

- New:** This record will be added to active configuration when committed.
- Modified:** Modified record will become active configuration when committed.
- Deleted:** Deleted record will be removed from active configuration when committed.
- Active:** Active record, active configuration.

Add Remove Reset

Cisco Unified SIP Proxy

Route Group 'RG-UC520' Element

Configure

- SIP Stack
 - General Settings
 - Alias FQDNs
 - TLS Trusted Peers
- Networks
- Triggers
- Server Groups
 - General Settings
 - Groups
 - SIP Ping
 - Call Admission Control
- Route Groups**
- Route Tables
- Route Policies
- Normalization Policies
- Time Policies
- Routing Triggers
- Normalization Triggers
 - Pre-Normalization
 - Post-Normalization
- Performance Control
- Call Admission Control
- ...

Target Destinations

Host / Server Group:	SG-UC520
Port:	
Transport Type:	None (default)

Options

	Active Value	Candidate Value
Network:	Net-UC520	Net-UC520
Q-Value:	1.0	1.0
Weight:	0	0
Time Policy:	None	None
Fallback Response Codes:	602,603	602,603

Update Cancel

Cisco Unified SIP Proxy

Server Group 'SG-UC520'

Configure

- SIP Stack
 - General Settings
 - Alias FQDNs
 - TLS Trusted Peers
- Networks
- Triggers
- Server Groups
 - General Settings
 - Groups**
 - SIP Ping
- ...

Server Group Elements

Status	IP Address	Port	Transport	Nested Server Group	Q-Value	Weight
Active	14.128.100.161	5060	UDP	-	10	0

Add Remove MoveUp

DEBUG

```
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.10] INFO 2013.02.28 05:28:57:365 loadbalancer.LBFactory -
lbtype is 0(global)
[REQUESTI.10] INFO 2013.02.28 05:28:57:365 loadbalancer.LBFactory -
Default lbtype is 3(call-id)
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 loadbalancer.LBBase -
Entering getServer()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 loadbalancer.LBBase -
Entering initializeDomains()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:365 servergroups.
ServerGlobalStateWrapper - Net-UC520:14.128.100.161:5060:1 numTries=
2--->isServerAvailable(): true
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:366 loadbalancer.LBBase -
Leaving initializeDomains()
[REQUESTI.10] INFO 2013.02.28 05:28:57:366 loadbalancer.LBHashBased -
list of elements in order on which load balancing is done :
{reSgElementWeight=0, reSgElementSgName=SG-UC520, reSgElementTransport=UDP,
reSgElementQValue=1.0, reSgElementPort=5060, reSgElementHost=14.128.100.161},
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:366 servergroups.AbstractNextHop -
Entering compareDomainNames()
```

```

[REQUESTI.10] DEBUG 2013.02.28 05:28:57:366 servergroups.AbstractNextHop -
Leaving compareDomainNames()
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:366 loadbalancer.LBBase -
Server group SG-UC520 selected {reSgElementWeight=0, reSgElementSgName=SG-UC520,
reSgElementTransport=UDP, reSgElementQValue=1.0, reSgElementPort=5060,
reSgElementHost=14.128.100.161}
[REQUESTI.10] DEBUG 2013.02.28 05:28:57:366 loadbalancer.LBBase -
Leaving getServer()

```

10. The SIP INVITE is sent to the selected element.

```

[REQUESTI.10] DEBUG 2013.02.28 05:28:57:367 DsSipLlApi.Wire -
Sending UDP packet on 14.128.100.169:32773, destination 14.128.100.161:5060
INVITE sip:4002@SG-UC520 SIP/2.0
Via: SIP/2.0/UDP
14.128.100.169:5062;branch=z9hG4bK.ToYJFeKMyfZGySv.gcLjg~~237
Via: SIP/2.0/UDP 14.128.100.150:5060;branch=z9hG4bK2292567
Max-Forwards: 69
To: <sip:4002@14.128.100.169>
From: <sip:85224044444@14.128.100.150>;tag=84086F7C-10B8
Contact: <sip:85224044444@14.128.100.150:5060>
Expires: 180
Remote-Party-ID: <sip:85224044444@14.128.100.150>
;party=calling;screen=no;privacy=off
Call-ID: 9559E957-809E11E2-9856EC62-1B7185EE@14.128.100.150
CSeq: 101 INVITE
Content-Length: 276
Date: Thu, 28 Feb 2013 05:28:57 GMT
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 2446255913-2157842914-2555505762-0460424686
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
Timestamp: 1362029337
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
o=CiscoSystemsSIP-GW-UserAgent 3653 4016 IN IP4 14.128.100.150
s=SIP Call
c=IN IP4 14.128.100.150
t=0 0
m=audio 19202 RTP/AVP 18 101
c=IN IP4 14.128.100.150
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20

```

Scenario 4

Call Flow:**IP Phone 1 -- CME 1 -- SIP -- CUSP -- SIP -- CME 2 -- IP Phone 2**

Dial 4444 from IP Phone 2 which is changed to 415 240 4444 with Post-Normalization in order to reach IP Phone 1.

CME 2 is UC520 in this scenario and CME 1 acts as PSTN.

1. The SIP INVITE comes to CUSP from CME 2 (UC520).

```
[DsTransportListener-1] DEBUG 2013.02.28 07:06:57:220 DsSipLlApi.Wire -
```

```

Received UDP packet on 14.128.100.169:5063 ,source 14.128.100.161:59404
INVITE sip:4444@14.128.100.169:5063 SIP/2.0
Date: Thu, 28 Feb 2013 07:09:20 GMT
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
From: <sip:4001@14.128.100.161>;tag=256D566C-22AC
Allow-Events: telephone-event
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Remote-Party-ID: <sip:4001@14.128.100.161>
;party=calling;screen=no;privacy=off
Cisco-Guid: 2598740490-2158760418-2150671243-2598404062
Timestamp: 1362035360
Content-Length: 543
User-Agent: Cisco-SIPGateway/IOS-12.x
To: <sip:4444@14.128.100.169>
Contact: <sip:4001@14.128.100.161:5060>
Expires: 180
Content-Type: multipart/mixed;boundary=uniqueBoundary
Call-ID: 9B62C157-80AC11E2-8035A38B-9AE07FDE@14.128.100.161
Via: SIP/2.0/UDP 14.128.100.161:5060;branch=z9hG4bK21E82
CSeq: 101 INVITE
Max-Forwards: 70
Mime-Version: 1.0

--uniqueBoundary
Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
o=CiscoSystemsSIP-GW-UserAgent 3418 2914 IN IP4 14.128.100.161
s=SIP Call
c=IN IP4 14.128.100.161
t=0 0
m=audio 17618 RTP/AVP 18 101
c=IN IP4 14.128.100.161
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20

--uniqueBoundary
Content-Type: application/gtd
Content-Disposition: signal;handling=optional

IAM,
GCI,9ae5a20a80ac11e28030a38b9ae07fde

--- end of packet ---

```

2. The call is accepted on the network (Net-From-UC520) configuration that matches.

CLI

```

sip listen Net-From-UC520 udp 14.128.100.169 5063
!
sip network Net-From-UC520 standard
  no non-invite-provisional
  allow-connections
  retransmit-count invite-client-transaction 3
  retransmit-count invite-server-transaction 5
  retransmit-count non-invite-client-transaction 3
  retransmit-timer T1 500
  retransmit-timer T2 4000
  retransmit-timer T4 5000

```

```

retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has a tree view with 'Configure' expanded, showing 'SIP Stack', 'Triggers' (which is selected), and 'Server Groups'. Under 'Triggers', 'Pre-Normalization' is selected. The main pane is titled 'Network: "Net-From-UC520"' and shows the 'SIP Listen Points' tab. It lists two entries: '192.168.1.100' and '192.168.1.101'. Both entries have port 5063 and transport set to 'udp'. There are 'Add' and 'Remove' buttons at the bottom.

DEBUG

```

[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.RegexCondition -
inNetwork='Net-From-UC520'
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.RegexCondition -
IN_NETWORK: Net-From-UC520

```

3. The Pre-Normalization sequence is executed.

CLI

```
trigger pre-normalization sequence 1 policy CUCM-Prefix-408 condition
TC-from-CUCM
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has a tree view with 'Configure' expanded, showing 'SIP Stack', 'Triggers' (selected), and 'Server Groups'. Under 'Triggers', 'Pre-Normalization' is selected. The main pane is titled 'Pre-Normalization Triggers' and shows a table of triggers. It contains one entry: '1' with 'Normalization Policy Name' set to 'CUCM-Prefix-408' and 'Trigger Condition Name' set to 'TC-from-CUCM'. There are 'Add', 'Edit', 'Remove', and 'Move Up/Down' buttons at the bottom.

DEBUG

```

[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 util.Normalization -
Entering Normalization(moduleRequest:pre-normalize)
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.RegexCondition -
inNetwork='Net-From-UC520'
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.RegexCondition -
IN_NETWORK: Net-From-UC520
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.AbstractRegexCondition -
pattern(^QNet-CUCM\E$), toMatch(Net-From-UC520) returning false
[REQUESTI.5] INFO 2013.02.28 07:06:57:229 util.Normalization -

```

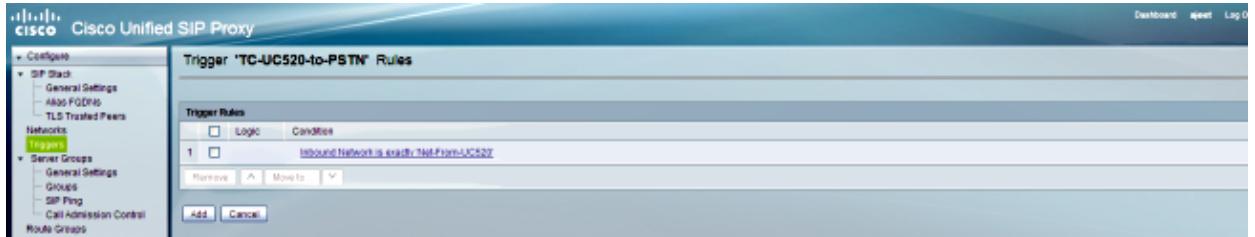
skipping pre-normalize, due to either no trigger is configured or triggers did not evaluate to true or is configured to by-pass

4. The Trigger Condition (TC-UC520-to-PSTN) is matched.

CLI

```
!
trigger condition TC-UC520-to-PSTN
sequence 1
    in-network ^\QNet-From-UC520\E$
end sequence
end trigger condition
!
```

GUI



DEBUG

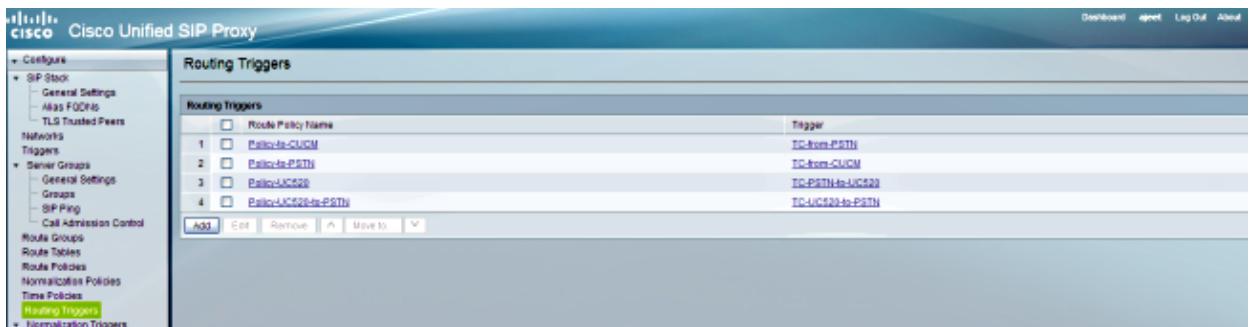
```
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.RegexCondition -
inNetwork='Net-From-UC520'
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:229 conditions.RegexCondition -
IN_NETWORK: Net-From-UC520
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 conditions.AbstractRegexCondition -
pattern(^\\QNet-From-UC520\\E$), toMatch(Net-From-UC520) returning true
```

5. The Routing Trigger configuration is checked in order to find the Route Policy (Policy-UC520-to-PSTN) that matches based on the Trigger Condition (TC-UC520-to-PSTN).

CLI

```
trigger routing sequence 4 policy Policy-UC520-to-PSTN condition
TC-UC520-to-PSTN
```

GUI



DEBUG

```
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 triggers.ModuleTrigger -
```

```
ModuleTrigger.eval() action<Policy-UC520-to-PSTN> actionParameter<>
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 triggers.ModuleTrigger -
ModuleTrigger.eval() got the policy, executing it ...
```

6. The Route Policy (Policy-UC520-to-PSTN) configuration is checked in order to find the Route Table (RT-UC520-PSTN) that matches.

CLI

```
!
policy lookup Policy-UC520-to-PSTN
sequence 100 RT-UC520-PSTN request-uri uri-component user
modify-key 4444 3333
rule exact
end sequence
end policy
!
```

GUI

The screenshot shows the Cisco Unified SIP Proxy configuration interface. The left sidebar has sections like SIP Stack, Networks, Triggers, and Server Groups. The main area is titled 'Route Policy "Policy-UC520-to-PSTN" Steps'. It lists one step: 'Active' with 'Key' set to 'Request-URI:User' and 'Lookup Rule' set to 'Exact'. A 'Route Table' dropdown shows 'RT-UC520-PSTN'.

This screenshot shows the 'Route Policy Step' configuration dialog. It's for the 'RT-UC520-PSTN' route table. The 'Lookup Key Matches' is set to 'Exactly' and 'Case Sensitive' is 'Disabled'. The 'Candidate Value' dropdown shows 'RT-UC520-PSTN'. Below it, 'Lookup Key' is set to 'RequestURI:User' with 'RequestURI' selected. Under 'Lookup Key Modifiers', 'Regular Expression MATCH' is '4444' and 'Replace' is '3333'. Both 'Remove leading '+' symbol' and 'Remove separator characters' are 'Disabled'. At the bottom are 'Update' and 'Cancel' buttons.

DEBUG

```
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.XCLPrefix -
Entering getKeyValue()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.FieldSelector -
getUriPart: URI - sip:4444@14.128.100.169:5063 part 6
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.FieldSelector -
Requested field 45
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.FieldSelector -
Returning key 4444
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.FieldSelector -
Retrieved Modifier RegexModifier: match= 4444, replace= 3333,
ignore case= false
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.FieldSelector -
Input field: 4444
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.FieldSelector -
Modified field: 3333
```

```
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 nrs.XCLPrefix -
Leaving getKeyValue()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 modules.XCLLookup -
table=RT-UC520-PSTN, key=3333
[REQUESTI.5] INFO 2013.02.28 07:06:57:230 modules.XCLLookup -
table is RT-UC520-PSTN
```

7. The Route Table (RT-UC520-PSTN) configuration is checked in order to find the Target Destination (RG-UC520).

CLI

```
!
route table RT-UC520-PSTN
  key 3333 group RG-UC520-to-PSTN
end route table
!
```

GUI

State	Key	Route Group	Target Destination	Next Hop	Response	Lookup Route Policy	Default SIP Route	Notes
<input type="checkbox"/>	Active	3333	RG-UC520-to-PSTN					

Note:
New : New record, will be added to active configuration when committed.
Modified : Modified record, will become active configuration when committed.
Deleted : Deleted record, will be removed from active configuration when committed.

Active Value

Key 3333
Route Type: route-group
Route Group: RG-UC520-to-PSTN

Candidate Value

- Key 3333
- Route Type: route-group
- Route Group: RG-UC520-to-PSTN

Buttons: Update, Cancel

DEBUG

```
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:230 routingtables.RoutingTable -
Entering lookup()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 routingtables.RoutingTable -
Looking up 3333 in table RT-UC520-PSTN with rule exact and modifiers=none
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 routingtables.RoutingTable -
Entering applyModifiers()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 routingtables.RoutingTable -
Leaving applyModifiers(), returning 3333
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 routingtables.RoutingTable -
Leaving lookup()
[REQUESTI.5] INFO 2013.02.28 07:06:57:231 nrs.XCLPrefix -
NRS Routing decision is: RouteTable:RT-UC520-PSTN, RouteKey:3333,
RouteGroup:RG-UC520-to-PSTN
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 loadbalancer.LBFactory -
Entering createLoadBalancer()
[REQUESTI.5] INFO 2013.02.28 07:06:57:231 loadbalancer.LBFactory -
lbtype is 3(call-id)
```

```

[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 loadbalancer.LBFactory -
Leaving createLoadBalancer()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.XCLPrefix -
Stored NRSAlgResult=isFound=true, isFailure=false, Response=-1,
Routes=[Ruri: 14.128.100.150, Route: null, Network: Net-From-UC520,
q-value=1.0advance=[502, 503]], PolicyAdvance=null
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.NRSAlgResult -
set policyAdvance as specified in route=RouteTable:RT-UC520-PSTN,
RouteKey:3333, RouteGroup:RG-UC520-to-PSTN
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.NRSAlgResult -
no policyAdvance specified in route
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.NRSAlgResult -
set policyAdvance as specified in algorithm={lookupkeymodifier=
[ RegexModifier: match= 4444, replace= 3333, ignore case= false],
lookuprule=0, lookupfield=45, lookuptable=RT-UC520-PSTN,
sequence=100, algorithm=1}
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.NRSAlgResult -
no policyAdvance specified in algorithm

```

8. The Post-Normalization sequence is executed.

CLI

```
trigger post-normalization sequence 1 policy UC520-Four-to-Full
condition TC-UC520-to-PSTN
```

```
!
policy normalization UC520-Four-to-Full
uri-component update request-uri user 4444 85224044444
end policy
!
```

GUI

Trigger Condition Name
TC-UC520-to-PSTN

Match Pattern	Replace Value
4444	85224044444

DEBUG

```
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 util.Normalization -
```

```

Entering Normalization(moduleRequest:post-normalize)
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 conditions.RegexCondition -
inNetwork='Net-From-UC520'
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 conditions.RegexCondition -
IN_NETWORK: Net-From-UC520
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 conditions.AbstractRegexCondition -
pattern(^\\QNet-From-UC520\\E$), toMatch(Net-From-UC520) returning true
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 triggers.ModuleTrigger -
ModuleTrigger.eval() action<UC520-Four-to-Full> actionParameter<>
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 triggers.ModuleTrigger -
ModuleTrigger.eval() got the policy, executing it ...
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 normalization.URIComponentNormalizationAlgorithm -
normalizing request-uri
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 normalization.URIComponentNormalizationAlgorithm -
updating user/phone of the sip:4444@14.128.100.150 to 85224044444
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 util.Normalization -
Leaving Normalization.normalize()

```

9. The Route Group configuration is checked in order to find the element IP address, and the call is routed to the best route possible based on the Q-value and Weight setting.

CLI

```

!
route group RG-UC520-to-PSTN
  element target-destination 14.128.100.150 Net-From-UC520 q-value 1.0
    failover-codes 502 - 503
      weight 0
    end element
  end route
!

```

GUI

State	Host / Server Group	Port	Transport	Next Hop	Network	Q-Value	Weight	Time Policy	Failover Response Codes
Active	14.128.100.150	-	-	-	Net-From-UC520	1.0	0	-	[502, 503]

	Active Value	Candidate Value
Network:	Net-From-UC520	Net-From-UC520
Q-Value:	1.0	1.0
Weight:	0	0
Time Policy:	None	FA0X4
Failover Response Codes:	502,503	502,503

DEBUG

```

[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 loadbalancer.LBBase -
Entering getServer()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 loadbalancer.LBBase -
Entering initializeDomains()
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.NRSRoutes -
routes before applying time policies: [Ruri: 14.128.100.150,
Route: null, Network: Net-From-UC520, q-value=1.0radvance=[502, 503]]
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 nrs.NRSRoutes -
routes after applying time policies: [Ruri: 14.128.100.150, Route:
null, Network: Net-From-UC520, q-value=1.0radvance=[502, 503]]
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:231 loadbalancer.LBBase -
Leaving initializeDomains()
[REQUESTI.5] INFO 2013.02.28 07:06:57:231 loadbalancer.LBHashBased -
list of elements in order on which load balancing is done : Ruri:
14.128.100.150, Route: null, Network: Net-From-UC520, q-value=
1.0radvance=[502, 503],
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 loadbalancer.LBBase -
Server group route-sg selected Ruri: 14.128.100.150, Route: null,
Network: Net-From-UC520, q-value=1.0radvance=[502, 503]
[REQUESTI.5] DEBUG 2013.02.28 07:06:57:232 loadbalancer.LBBase -
Leaving getServer()

```

10. The SIP INVITE is sent to the selected element.

```

[REQUESTI.5] DEBUG 2013.02.28 07:06:57:233 DsSipLlApi.Wire -
Sending UDP packet on 14.128.100.169:32770, destination 14.128.100.150:5060
INVITE sip:85224044444@14.128.100.150 SIP/2.0
Via: SIP/2.0/UDP
14.128.100.169:5063;branch=z9hG4bK.ToYJFeKMyfZGySv.gcLjg~~~238
Via: SIP/2.0/UDP 14.128.100.161:5060;branch=z9hG4bK21E82
Max-Forwards: 69
To: <sip:4444@14.128.100.169>
From: <sip:4001@14.128.100.161>;tag=256D566C-22AC
Contact: <sip:4001@14.128.100.161:5060>
Expires: 180
Remote-Party-ID: <sip:4001@14.128.100.161>
;party=calling;screen=no;privacy=off
Call-ID: 9B62C157-80AC11E2-8035A38B-9AE07FDE@14.128.100.161
CSeq: 101 INVITE
Content-Length: 543
Date: Thu, 28 Feb 2013 07:09:20 GMT
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER,
SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 2598740490-2158760418-2150671243-2598404062
Timestamp: 1362035360
User-Agent: Cisco-SIPGateway/IOS-12.x
Content-Type: multipart/mixed;boundary=uniqueBoundary
MIME-Version: 1.0

--uniqueBoundary
Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
o=CiscoSystemsSIP-GW-UserAgent 3418 2914 IN IP4 14.128.100.161
s=SIP Call
c=IN IP4 14.128.100.161
t=0 0
m=audio 17618 RTP/AVP 18 101
c=IN IP4 14.128.100.161
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16

```

```

a=ptime:20

--uniqueBoundary
Content-Type: application/gtd
Content-Disposition: signal;handling=optional

IAM,
GCI,9ae5a20a80ac11e28030a38b9ae07fde

```

Configuration for All Four Scenarios

Here is the complete CUSP configuration for all four call scenarios described in this document:

```

a@eesing-cusp-8.5.3(cusp)# show configuration active verbose
Building CUSP configuration...
!
server-group sip global-load-balance call-id
server-group sip retry-after 0
server-group sip element-retries udp 2
server-group sip element-retries tls 1
server-group sip element-retries tcp 1
sip dns-srv
enable
no naptr
end dns
!
no sip header-compaction
!
sip logging
sip max-forwards 70
sip network Net-CUCM standard
no non-invite-provisional
allow-connections
retransmit-count invite-client-transaction 3
retransmit-count invite-server-transaction 5
retransmit-count non-invite-client-transaction 3
retransmit-timer T1 500
retransmit-timer T2 4000
retransmit-timer T4 5000
retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
!
sip network Net-From-UC520 standard
no non-invite-provisional
allow-connections
retransmit-count invite-client-transaction 3
retransmit-count invite-server-transaction 5
retransmit-count non-invite-client-transaction 3
retransmit-timer T1 500
retransmit-timer T2 4000
retransmit-timer T4 5000
retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
!
sip network Net-PSTN standard

```

```
no non-invite-provisional
allow-connections
retransmit-count invite-client-transaction 3
retransmit-count invite-server-transaction 5
  retransmit-count non-invite-client-transaction 3
retransmit-timer T1 500
retransmit-timer T2 4000
retransmit-timer T4 5000
retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
!
sip network Net-UC520 standard
no non-invite-provisional
allow-connections
retransmit-count invite-client-transaction 3
retransmit-count invite-server-transaction 5
retransmit-count non-invite-client-transaction 3
retransmit-timer T1 500
retransmit-timer T2 4000
retransmit-timer T4 5000
retransmit-timer TU1 5000
retransmit-timer TU2 32000
retransmit-timer clientTn 64000
retransmit-timer serverTn 64000
tcp connection-setup-timeout 1000
udp max-datatype-size 1500
end network
!
sip overload reject retry-after 0
sip peg-counting 2 86400
sip privacy service
sip queue message
  drop-policy head
  low-threshold 80
  size 2000
  thread-count 20
end queue
!
sip queue radius
  drop-policy head
  low-threshold 80
  size 2000
  thread-count 20
end queue
!
sip queue request
  drop-policy head
  low-threshold 80
  size 2000
  thread-count 20
end queue
!
sip queue response
  drop-policy head
  low-threshold 80
  size 2000
  thread-count 20
end queue
!
sip queue st-callback
  drop-policy head
```

```
low-threshold 80
size 2000
thread-count 10
end queue
!
sip queue timer
drop-policy none
low-threshold 80
size 2500
thread-count 8
end queue
!
sip queue xcl
drop-policy head
low-threshold 80
size 2000
thread-count 2
end queue
!
route recursion
!
sip tcp connection-timeout 30
sip tcp max-connections 256
!
no sip tls
!
trigger condition TC-PSTN-to-UC520
sequence 1
in-network ^\QNet-UC520\E$
end sequence
sequence 2
in-network ^\QNet-CUCM\E$
end sequence
end trigger condition
!
trigger condition TC-UC520-to-PSTN
sequence 1
in-network ^\QNet-From-UC520\E$
end sequence
end trigger condition
!
trigger condition TC-from-CUCM
sequence 1
in-network ^\QNet-CUCM\E$
end sequence
end trigger condition
!
trigger condition TC-from-PSTN
sequence 1
in-network ^\QNet-PSTN\E$
end sequence
sequence 2
in-network ^\QNet-CUCM\E$
message request
end sequence
end trigger condition
!
trigger condition mid-dialog
sequence 1
mid-dialog
end sequence
end trigger condition
!
accounting
no enable
no client-side
```

```

no server-side
end accounting
!
server-group sip group SG-CUCM.ajeet.com Net-CUCM
  element ip-address 14.128.64.191 5060 udp q-value 1 weight 50
    element ip-address 14.128.64.192 5060 udp q-value 1.0 weight 100
      failover-resp-codes 503
  lbtype global
  ping
end server-group
!
server-group sip group SG-PSTN Net-PSTN
  element ip-address 14.128.100.150 5060 udp q-value 1.0 weight 0
    failover-resp-codes 503
  lbtype global
  ping
end server-group
!
server-group sip group SG-UC520 Net-UC520
  element ip-address 14.128.100.161 5060 udp q-value 1.0 weight 0
    failover-resp-codes 503
  lbtype global
  ping
end server-group
!
route group RG-UC520
  element target-destination SG-UC520 Net-UC520 q-value 1.0
    failover-codes 502 - 503
    weight 0
  end element
end route
!
route group RG-UC520-to-PSTN
  element target-destination 14.128.100.150 Net-From-UC520 q-value 1.0
    failover-codes 502 - 503
    weight 0
  end element
end route
!
route table RT-CUCM
  key 1111 target-destination SG-CUCM.ajeet.com Net-CUCM
end route table
!
route table RT-PSTN
  key 4082022222 target-destination SG-PSTN Net-PSTN
end route table
!
route table RT-UC520
  key 2222 group RG-UC520
end route table
!
route table RT-UC520-PSTN
  key 3333 group RG-UC520-to-PSTN
end route table
!
policy normalization CUCM-Prefix-408
  uri-component update request-uri user 2022222 4082022222
end policy
!
policy normalization UC520-Four-to-Full
  uri-component update request-uri user 4444 85224044444
end policy
!
policy lookup Policy-UC520
  sequence 100 RT-UC520 request-uri uri-component user
    modify-key 400[12] 2222

```

```

rule exact
end sequence
end policy
!
policy lookup Policy-UC520-to-PSTN
sequence 100 RT-UC520-PSTN request-uri uri-component user
modify-key 4444 3333
rule exact
end sequence
end policy
!
policy lookup Policy-to-CUCM
sequence 100 RT-CUCM request-uri uri-component user
modify-key 4082022102 1111
rule exact
end sequence
end policy
!
policy lookup Policy-to-PSTN
sequence 100 RT-PSTN request-uri uri-component user
rule exact
end sequence
end policy
!
trigger routing sequence 1 policy Policy-to-CUCM condition
TC-from-PSTN
trigger routing sequence 2 policy Policy-to-PSTN condition
TC-from-CUCM
trigger routing sequence 3 policy Policy-UC520 condition
TC-PSTN-to-UC520
trigger routing sequence 4 policy Policy-UC520-to-PSTN condition
TC-UC520-to-PSTN
trigger pre-normalization sequence 1 policy CUCM-Prefix-408
condition TC-from-CUCM
trigger post-normalization sequence 1 policy UC520-Four-to-Full
condition TC-UC520-to-PSTN
!
server-group sip ping-options Net-CUCM 14.128.100.169 4001
method OPTIONS
ping-type proactive 2500
timeout 2000
end ping
!
server-group sip global-ping
sip cac session-timeout 720
sip cac Net-CUCM 14.128.64.191 5060 udp limit -1
sip cac Net-CUCM 14.128.64.192 5060 udp limit -1
sip cac Net-PSTN 14.128.100.150 5060 udp limit -1
sip cac Net-UC520 14.128.100.161 5060 udp limit -1
!
no sip cac
!
sip listen Net-CUCM udp 14.128.100.169 5061
sip listen Net-From-UC520 udp 14.128.100.169 5063
sip listen Net-PSTN udp 14.128.100.169 5060
sip listen Net-UC520 udp 14.128.100.169 5062
!
call-rate-limit 200
!
end
ajeesing-cusp-8.5.3(cusp)#

```

Verify

There is currently no verification procedure available for this configuration.

Troubleshoot

There is currently no specific troubleshooting information available for this configuration.

Related Information

- *CLI Configuration Guide for Cisco Unified SIP Proxy Release 8.5*
- *GUI Administration Guide for Cisco Unified SIP Proxy Release 8.5*
- *CUSP Call Processing*
- *Technical Support & Documentation – Cisco Systems*

Updated: Aug 06, 2013

Document ID: 116252
