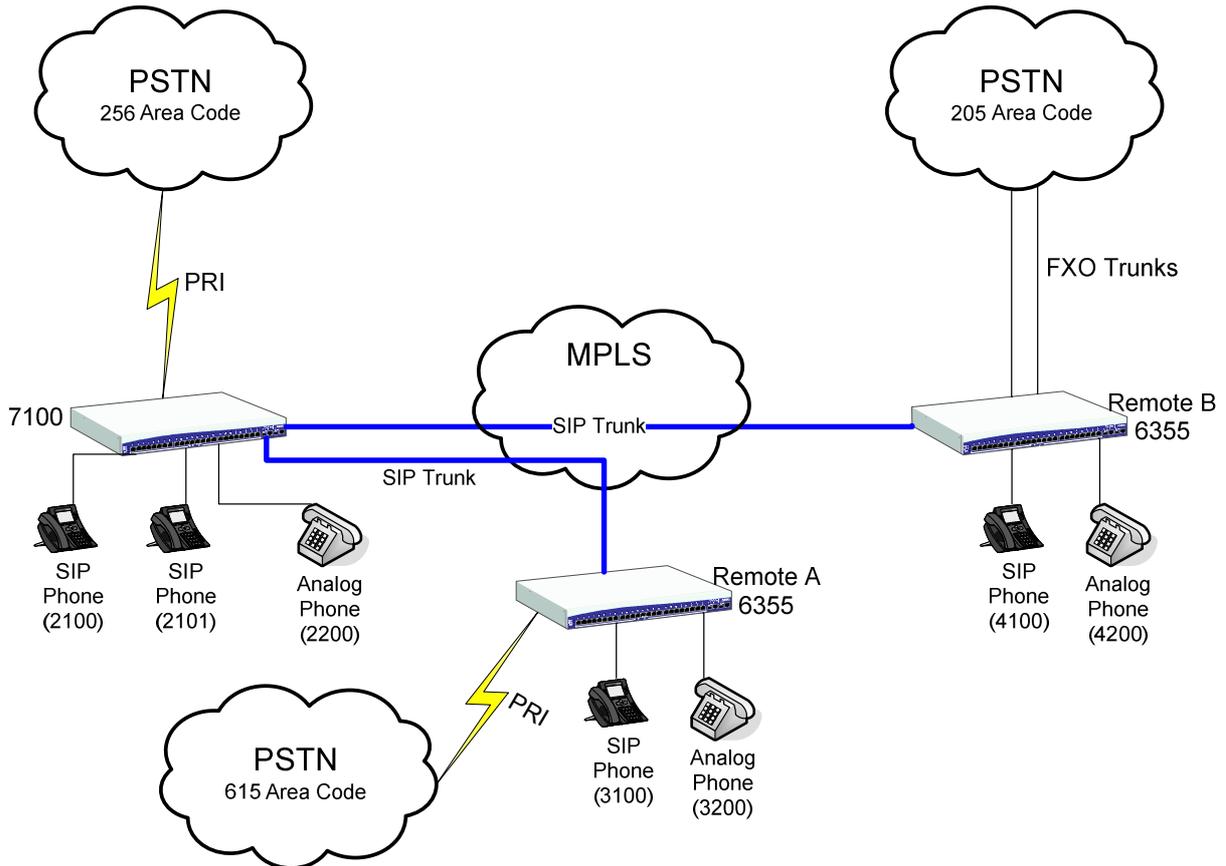# Multi-site Application using NetVanta 7100 and 6355

The following guide explains how to configure a NetVanta 7100 and a NetVanta 6355 for least cost routing and optionally toll avoidance. It is based off the diagram shown below.

	eth 0/0	VLAN 1	VLAN 2
NV 7100	192.0.2.2 /30	10.10.10.0 /24	10.10.20.0 /24
Remote A NV 6355	192.0.2.6 /30	10.20.10.0 /24	10.20.20.0 /24
Remote B NV 6355	192.0.2.10 /30	10.30.10.0 /24	10.30.20.0 /24

Extension Planning

Before you begin configuring the systems for this application, plan which extensions will be used at each site. It is recommended that you use patterns that are easily matched by wildcards, such as 2XXX, 3XXX, and 4XXX as shown in the diagram above that will be used in this guide.

Media Gateway Configuration

Because inbound calls from the trunks at remote sites will be routed through the NetVanta 7100, it is best to use a loopback interface for the media-gateway on all IP interfaces on both devices.

NetVanta 7100

```
interface loop 1
  ip address  10.10.20.2  255.255.255.255
  no shutdown
!
interface vlan 1
  …
  media-gateway ip loopback 1
!
interface vlan 2
  …
  media-gateway ip loopback 1
!
interface eth 0/0
  …
  media-gateway ip loopback 1
```

Remote Site A

```
interface loop 1
  ip address  10.20.20.2  255.255.255.255
  no shutdown
!
interface vlan 1
  …
  media-gateway ip loopback 1
!
interface vlan 2
  …
  media-gateway ip loopback 1
!
interface eth 0/0
  …
  media-gateway ip loopback 1
```

Remote Site B

```
interface loop 1
  ip address  10.30.20.2  255.255.255.255
  no shutdown
!
interface vlan 1
  …
  media-gateway ip loopback 1
```

```
!
interface vlan 2
  …
  media-gateway ip loopback 1
!
interface eth 0/0
  …
  media-gateway ip loopback 1
```

Phone and Voice User Configuration

Since **interface loop 1** is being used as the media-gateway, the phones will need to use the loopback IP address as their SIP server. That means for the scenario used in this document, all phones will use 10.10.20.2 as their SIP server.

Steps 5 and 6 from the Remote Phone Configuration Guide (http://kb.adtran.com/article.asp?article=2072&p=2) should be followed for all remote phones to ensure they are able to pull their configuration files from the NetVanta 7100. In this scenario, eth 0/0 is being used as the WAN on both devices.

NetVanta 6355 DHCP Pool Configuration

The DHCP pools for the phones on the remote NetVanta 6355 should be setup to point to the WAN interface (eth 0/0 in this scenario) of the NetVanta 7100 for the boot server. In this scenario, the DHCP pools on the NetVanta 6355s would be configured as shown below:

Remote Site A

```
ip dhcp-server pool "LAN_pool"
  network 10.20.10.0 255.255.255.0
  dns-server 10.20.10.1
  netbios-node-type h-node
  default-router 10.20.10.1
  ntp-server 10.20.10.1
  timezone-offset -6:00
  option 66 ascii ftp://polycomftp:password@192.0.2.2/Polycom
  option 157 ascii
TftpServers=0.0.0.0,FtpServers=192.0.2.2:/ADTRAN,FtpLogin=polycomftp,FtpPassw
ord=password,Layer2Tagging=True,VlanID=2
!
ip dhcp-server pool "VoIP_pool"
  network 10.20.20.0 255.255.255.0
  dns-server 10.20.20.1
  netbios-node-type h-node
  default-router 10.20.20.1
  ntp-server 10.20.20.1
  timezone-offset -6:00
  option 66 ascii ftp://polycomftp:password@192.0.2.2/Polycom
  option 157 ascii
TftpServers=0.0.0.0,FtpServers=192.0.2.2:/ADTRAN,FtpLogin=polycomftp,FtpPassw
ord=password,Layer2Tagging=True,VlanID=2
```

Remote Site B

```
ip dhcp-server pool "LAN_pool"
```

```
   network 10.30.10.0 255.255.255.0
   dns-server 10.30.10.1
   netbios-node-type h-node
   default-router 10.30.10.1
   ntp-server 10.30.10.1
   timezone-offset -6:00
   option 66 ascii ftp://polycomftp:password@192.0.2.2/Polycom
   option 157 ascii
 TftpServers=0.0.0.0,FtpServers=192.0.2.2:/ADTRAN,FtpLogin=polycomftp,FtpPassw
 ord=password,Layer2Tagging=True,VlanID=2
 !
 ip dhcp-server pool "VoIP_pool"
   network 10.30.20.0 255.255.255.0
   dns-server 10.30.20.1
   netbios-node-type h-node
   default-router 10.30.20.1
   ntp-server 10.30.20.1
   timezone-offset -6:00
   option 66 ascii ftp://polycomftp:password@192.0.2.2/Polycom
   option 157 ascii
 TftpServers=0.0.0.0,FtpServers=192.0.2.2:/ADTRAN,FtpLogin=polycomftp,FtpPassw
 ord=password,Layer2Tagging=True,VlanID=2
```

QoS Considerations

To ensure voice quality, QoS should be setup on all units as described in step 8 in the Remote Phone Configuration Guide (http://kb.adtran.com/article.asp?article=2072&p=2).

NetVanta 6355 SIP Trunk & Grouped Trunk Configuration

A SIP trunk and grouped trunk needs to be created on each NetVanta 6355 for the purpose of sending calls from the PSTN trunks on the NetVanta 6355 back to the NetVanta 7100 for routing. This trunk is also used for sending calls from analog phones to the NetVanta 7100 for routing. The IP address used should be the media gateway IP address (10.10.20.2). SIP keep-alives are used to make sure all units maintain the correct call state in case of network connectivity issues.

```
    voice trunk T01 type sip
      description "NV 7100"
      sip-server primary 10.10.20.2
      grammar from host local
      sip-keep-alive info 60
      default-ring-cadence internal
    !
    voice grouped-trunk NV7100
      no description
      trunk T01
      accept MXXX cost 0
      accept 9-NXX-XXXX cost 0
      accept 9-1-NXX-NXX-XXXX cost 0
      accept 9-1-800-NXX-XXXX cost 0
      accept 9-1-888-NXX-XXXX cost 0
      accept 9-1-877-NXX-XXXX cost 0
      accept 9-1-866-NXX-XXXX cost 0
      accept 9-1-855-NXX-XXXX cost 0
      accept 9-011-$ cost 0
      accept 9-411 cost 0
      accept 9-611 cost 0
```

```
   accept 9-911 cost 0
   accept 9-0-NXX-NXX-XXXX cost 0
   accept 9-10-10-XXX-$ cost 0
   reject 9-976-XXXX
   reject 9-1-900-NXX-XXXX
   reject 9-1-976-NXX-XXXX
```

NetVanta 6355 PSTN Trunks & Grouped Trunk Configuration

A trunk accounts and grouped trunk for the PSTN trunks needs to be created on each NetVanta 6355 for the purpose of sending calls from the NetVanta 6355 to the PSTN for least cost routing. This trunk is also used for sending calls to the PSTN directly when the NetVanta 7100 is unreachable.

The grouped trunk accepts numbers dialed both with and without a leading 9. Outbound calls that go through the NetVanta 7100 will have had the leading 9 stripped before reaching the NetVanta 6355. However, the leading 9 will not be stripped when the NetVanta 7100 is unreachable, which is why those number templates are also accepted. When present, such as during failover, the leading 9 is stripped on the voice trunk with the "match dnis" statements.

"prefer trunk-routing" is used to make the SIP trunk the first choice for routing calls from the PSTN trunks because all call routing and features are handled by the NetVanta 7100.

The cost is set to 200 so that analog phones on the NetVanta 6355 first attempt to route their calls to the NetVanta 7100 instead of directly out the PSTN trunks. This is done because the NetVanta 6355 cannot provide features locally.

Remote Site A

```
   voice trunk T02 type isdn
     description "PSTN"
     resource-selection linear descending
     connect isdn-group 1
     match dnis "9-NXX-XXXX" substitute "NXX-XXXX"
     match dnis "9-NXX-NXX-XXXX" substitute "NXX-NXX-XXXX"
     match dnis "9-1-NXX-NXX-XXXX" substitute "1-NXX-NXX-XXXX"
     match dnis "9-NXX" substitute "NXX"
     match dnis "9-011-$" substitute "011-$"
     rtp delay-mode adaptive
     prefer trunk-routing
   !
   voice grouped-trunk PRI
     no description
     trunk T02
     accept NXX-XXXX cost 200
     accept 1-NXX-NXX-XXXX cost 200
     accept 1-800-NXX-XXXX cost 200
     accept 1-888-NXX-XXXX cost 200
     accept 1-877-NXX-XXXX cost 200
     accept 1-866-NXX-XXXX cost 200
     accept 1-855-NXX-XXXX cost 200
     accept 011-$ cost 200
     accept 411 cost 200
     accept 611 cost 200
     accept 911 cost 200
     accept 0-NXX-NXX-XXXX cost 200
```

```
accept 10-10-XXX-$ cost 200
accept 9-NXX-XXXX cost 200
accept 9-1-NXX-NXX-XXXX cost 200
accept 9-1-800-NXX-XXXX cost 200
accept 9-1-888-NXX-XXXX cost 200
accept 9-1-877-NXX-XXXX cost 200
accept 9-1-866-NXX-XXXX cost 200
accept 9-1-855-NXX-XXXX cost 200
accept 9-011-$ cost 200
accept 9-411 cost 200
accept 9-611 cost 200
accept 9-911 cost 200
accept 9-0-NXX-NXX-XXXX cost 200
accept 9-10-10-XXX-$ cost 200
reject 976-XXXX
reject 1-900-NXX-XXXX
reject 1-976-NXX-XXXX
reject 9-976-XXXX
reject 9-1-900-NXX-XXXX
reject 9-1-976-NXX-XXXX
```

Remote Site B

```
voice trunk T02 type analog supervision loop-start
  description "PSTN"
  caller-id
  trunk-number 4300
  connect fxo 0/1
  connect fxo 0/2
  match dnis "9-NXX-XXXX" substitute "NXX-XXXX"
  match dnis "9-NXX-NXX-XXXX" substitute "NXX-NXX-XXXX"
  match dnis "9-1-NXX-NXX-XXXX" substitute "1-NXX-NXX-XXXX"
  match dnis "9-NXX" substitute "NXX"
  match dnis "9-011-$" substitute "011-$"
  rtp delay-mode adaptive
  prefer trunk-routing
!
voice grouped-trunk ANALOG_TRUNKS
  no description
  trunk T02
  accept NXX-XXXX cost 200
  accept 1-NXX-NXX-XXXX cost 200
  accept 1-800-NXX-XXXX cost 200
  accept 1-888-NXX-XXXX cost 200
  accept 1-877-NXX-XXXX cost 200
  accept 1-866-NXX-XXXX cost 200
  accept 1-855-NXX-XXXX cost 200
  accept 011-$ cost 200
  accept 411 cost 200
  accept 611 cost 200
  accept 911 cost 200
  accept 0-NXX-NXX-XXXX cost 200
  accept 10-10-XXX-$ cost 200
  accept 9-NXX-XXXX cost 200
  accept 9-1-NXX-NXX-XXXX cost 200
  accept 9-1-800-NXX-XXXX cost 200
  accept 9-1-888-NXX-XXXX cost 200
  accept 9-1-877-NXX-XXXX cost 200
  accept 9-1-866-NXX-XXXX cost 200
```

```
accept 9-1-855-NXX-XXXX cost 200
accept 9-011-$ cost 200
accept 9-411 cost 200
accept 9-611 cost 200
accept 9-911 cost 200
accept 9-0-NXX-NXX-XXXX cost 200
accept 9-10-10-XXX-$ cost 200
reject 976-XXXX
reject 1-900-NXX-XXXX
reject 1-976-NXX-XXXX
reject 9-976-XXXX
reject 9-1-900-NXX-XXXX
reject 9-1-976-NXX-XXXX
```

NetVanta 6355 SIP Proxy Configuration

To force all SIP phones on the NetVanta 6355s to use the SIP Proxy, it should be configured as follows:

```
ip sip proxy
ip sip proxy transparent
```

To force 911 calls to immediately be routed to the PSTN trunks on the NetVanta 6355 without first passing through the NetVanta 7100, add the following lines to the configuration:

```
ip sip proxy emergency-call-routing accept 911
ip sip proxy emergency-call-routing accept 9-911
```

NetVanta 6355 Analog User Configuration

Analog users on the NetVanta 6355s should be configured to register to the NetVanta 7100 via the SIP trunk. Analog user 4200 would be configured as follows on the Remote Site B NetVanta 6355.

```
voice user 4200
  connect fxs 0/1
  sip-identity 4200 T01 register auth-name 4200 password 1234
```

NetVanta 7100 Trunk Configuration

SIP trunks need to be created to on the 7100 destined to the media gateway IP address of each remote NetVanta 6355. These trunks are used for sending calls out the PSTN trunks on the remote NetVanta 6355s, and for receiving calls from the PSTN trunks on the remote devices. SIP keep-alives are used to make sure all units maintain the correct call state in case of network connectivity issues.

```
voice trunk T01 type isdn
  description "PSTN"
  resource-selection linear descending
  connect isdn-group 1
  rtp delay-mode adaptive
!
voice trunk T02 type sip
  description "Remote A"
  sip-server primary 10.20.20.2
  grammar from host local
  sip-keep-alive info 60
  default-ring-cadence internal
```

```
    !
    voice trunk T03 type sip
      description "Remote B"
      sip-server primary 10.30.20.2
      grammar from host local
      sip-keep-alive info 60
      default-ring-cadence internal
```

NetVanta 7100 Grouped Trunk Configuration

There are three common options for determining which users can use which PSTN trunks. The first option is to allow users from all sites to use all trunks in a true least cost routing scenario. The second option is to allow the remote site users to use their local trunks for local calls, but force all long distance calls out the PRI at the main site. The final option is to only allow users to use their local trunks for all calls

Option 1 – True Least Cost Routing

In a true least cost routing scenario, the trunks on the remote site NetVanta 6355s are used for calls that are local to those sites, and the PRI off the NetVanta 7100 is used for all other calls. The ANI lists and trunk lists are used to force 7 digit local dialing out the correct trunk. The trunk lists are needed because when a phone is forwarded, the call is considered to have originated from the trunk on which it was received. The additional SIP trunks for the remote sites are used to convert from 11 digit DNIS to 7 digit DNIS for dialing at the remote sites.

```
    voice ani-list Local_ANI
      ani 2XXX
    !
    voice ani-list Remote_A_ANI
      ani 3XXX
    !
    voice ani-list Remote_B_ANI
      ani 4XXX
    !
    voice trunk-list Local_Trunks
      trunk T01
    !
    voice trunk-list Remote_A_Trunks
      trunk T02
    !
    voice trunk-list Remote_B_Trunks
      trunk T03
    !
    voice trunk T04 type sip
      description "Remote A"
      match dnis 1-615-NXX-XXXX sub NXX-XXXX
      sip-server primary 10.20.20.2
      grammar from host local
      default-ring-cadence internal
    !
    voice trunk T05 type sip
      description "Remote B"
      match dnis 1-205-NXX-XXXX sub NXX-XXXX
      sip-server primary 10.30.20.2
      grammar from host local
      default-ring-cadence internal
```

```
!
voice grouped-trunk PRI
  no description
  trunk T01
  accept 1-NXX-NXX-XXXX cost 0
  accept 1-800-NXX-XXXX cost 0
  accept 1-888-NXX-XXXX cost 0
  accept 1-877-NXX-XXXX cost 0
  accept 1-866-NXX-XXXX cost 0
  accept 1-855-NXX-XXXX cost 0
  accept 011-$ cost 0
  accept 0-NXX-NXX-XXXX cost 0
  accept 10-10-XXX-$ cost 0
  reject 976-XXXX
  reject 1-900-NXX-XXXX
  reject 1-976-NXX-XXXX
!
voice grouped-trunk PRI_LOCAL_DIALING
  no description
  trunk T01
  accept NXX-XXXX cost 0
  accept 411 cost 0
  accept 611 cost 0
  accept 911 cost 0
  reject 976-XXXX
  permit list Local_ANI
  permit list Local_Trunks
!
voice grouped-trunk REMOTE_A_LOCAL_DIALING
  no description
  trunk T02
  accept NXX-XXXX cost 0
  accept 411 cost 0
  accept 611 cost 0
  accept 911 cost 0
  permit list Remote_A_ANI
  permit list Remote_A_Trunks
!
voice grouped-trunk REMOTE_A_REMOTE_DIALING
  no description
  trunk T04
  accept 1-615-NXX-XXXX cost 0
  permit list Local_ANI
  permit list Local_Trunks
  permit list Remote_B_ANI
  permit list Remote_B_Trunks
!
voice grouped-trunk REMOTE_B_LOCAL_DIALING
  no description
  trunk T03
  accept NXX-XXXX cost 0
  accept 411 cost 0
  accept 611 cost 0
  accept 911 cost 0
  permit list Remote_B_ANI
  permit list Remote_B_Trunks
!
voice grouped-trunk REMOTE_B_REMOTE_DIALING
  no description
  trunk T05
```

```
            accept 1-205-NXX-XXXX cost 0
            permit list Local_ANI
            permit list Local_Trunks
            permit list Remote_A_ANI
            permit list Remote_A_Trunks
```

Option 2 – Remote Sites Use Local Trunks for Local Calls

In this scenario, users at the remote sites are permitted to use their trunks for local calls, but long distance calls will be routed out the PRI at the main site. The ANI lists and trunk lists are used to force 7 digit local dialing out the correct trunk. The trunk lists are needed because when a phone is forwarded, the call is considered to have originated from the trunk on which it was received.

```
        voice ani-list Local_ANI
          ani 2XXX
        !
        voice ani-list Remote_A_ANI
          ani 3XXX
        !
        voice ani-list Remote_B_ANI
          ani 4XXX
        !
        voice trunk-list Local_Trunks
          trunk T01
        !
        voice trunk-list Remote_A_Trunks
          trunk T02
        !
        voice trunk-list Remote_B_Trunks
          trunk T03
        !
        voice grouped-trunk PRI
          no description
          trunk T01
          accept 1-NXX-NXX-XXXX cost 0
          accept 1-800-NXX-XXXX cost 0
          accept 1-888-NXX-XXXX cost 0
          accept 1-877-NXX-XXXX cost 0
          accept 1-866-NXX-XXXX cost 0
          accept 1-855-NXX-XXXX cost 0
          accept 011-$ cost 0
          accept 0-NXX-NXX-XXXX cost 0
          accept 10-10-XXX-$ cost 0
          reject 976-XXXX
          reject 1-900-NXX-XXXX
          reject 1-976-NXX-XXXX
        !
        voice grouped-trunk PRI_LOCAL_DIALING
          no description
          trunk T01
          accept NXX-XXXX cost 0
          accept 411 cost 0
          accept 611 cost 0
          accept 911 cost 0
          reject 976-XXXX
          permit list Local_ANI
          permit list Local_Trunks
        !
```

```
voice grouped-trunk REMOTE_A_LOCAL_DIALING
  no description
  trunk T02
  accept NXX-XXXX cost 0
  accept 411 cost 0
  accept 611 cost 0
  accept 911 cost 0
  permit list Remote_A_ANI
  permit list Remote_A_Trunks
!
voice grouped-trunk REMOTE_B_LOCAL_DIALING
  no description
  trunk T03
  accept NXX-XXXX cost 0
  accept 411 cost 0
  accept 611 cost 0
  accept 911 cost 0
  permit list Remote_B_ANI
  permit list Remote_B_Trunks
```

Option 3 – Remote Sites Use Local Trunks for All Calls

In this scenario, users from each site only use the trunks that are local to their site. The ANI lists and trunk lists are used to force calls out the correct trunk based on which site the call was originated from. The trunk lists are needed because when a phone is forwarded, the call is considered to have originated from the trunk on which it was received.

```
voice ani-list Local_ANI
  ani 2XXX
!
voice ani-list Remote_A_ANI
  ani 3XXX
!
voice ani-list Remote_B_ANI
  ani 4XXX
!
voice trunk-list Local_Trunks
  trunk T01
!
voice trunk-list Remote_A_Trunks
  trunk T02
!
voice trunk-list Remote_B_Trunks
  trunk T03
!
voice grouped-trunk PRI
  no description
  trunk T01
  accept NXX-XXXX cost 0
  accept 1-NXX-NXX-XXXX cost 0
  accept 1-800-NXX-XXXX cost 0
  accept 1-888-NXX-XXXX cost 0
  accept 1-877-NXX-XXXX cost 0
  accept 1-866-NXX-XXXX cost 0
  accept 1-855-NXX-XXXX cost 0
  accept 011-$ cost 0
  accept 411 cost 0
  accept 611 cost 0
```

```
    accept 911 cost 0
    accept 0-NXX-NXX-XXXX cost 0
    accept 10-10-XXX-$ cost 0
    reject 976-XXXX
    reject 1-900-NXX-XXXX
    reject 1-976-NXX-XXXX
    permit list Local_ANI
    permit list Local_Trunks
!
voice grouped-trunk REMOTE_A_TRUNKS
    no description
    trunk T02
    accept NXX-XXXX cost 0
    accept 1-NXX-NXX-XXXX cost 0
    accept 1-800-NXX-XXXX cost 0
    accept 1-888-NXX-XXXX cost 0
    accept 1-877-NXX-XXXX cost 0
    accept 1-866-NXX-XXXX cost 0
    accept 1-855-NXX-XXXX cost 0
    accept 011-$ cost 0
    accept 411 cost 0
    accept 611 cost 0
    accept 911 cost 0
    accept 0-NXX-NXX-XXXX cost 0
    accept 10-10-XXX-$ cost 0
    reject 976-XXXX
    reject 1-900-NXX-XXXX
    reject 1-976-NXX-XXXX
    permit list Remote_A_ANI
    permit list Remote_A_Trunks
!
voice grouped-trunk REMOTE_B_LOCAL_DIALING
    no description
    trunk T03
    accept NXX-XXXX cost 0
    accept 1-NXX-NXX-XXXX cost 0
    accept 1-800-NXX-XXXX cost 0
    accept 1-888-NXX-XXXX cost 0
    accept 1-877-NXX-XXXX cost 0
    accept 1-866-NXX-XXXX cost 0
    accept 1-855-NXX-XXXX cost 0
    accept 011-$ cost 0
    accept 411 cost 0
    accept 611 cost 0
    accept 911 cost 0
    accept 0-NXX-NXX-XXXX cost 0
    accept 10-10-XXX-$ cost 0
    reject 976-XXXX
    reject 1-900-NXX-XXXX
    reject 1-976-NXX-XXXX
    permit list Remote_B_ANI
    permit list Remote_B_Trunks
```