Application Note

Avaya S8500 Communications Manager 2.1 to Cisco IOS Voice Gateway using E1 NET5 with H.323

October 30, 2007 Revision 4

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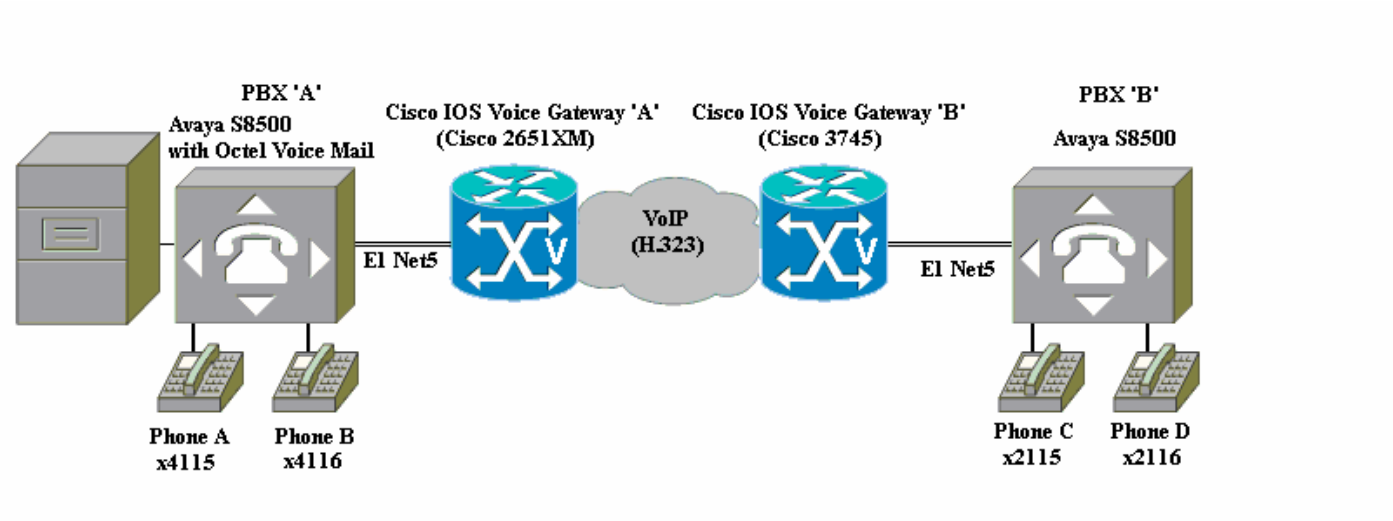
Introduction

- Although specific gateway router models were used to validate its content, this application note also applies to all Cisco 1700/2600/3600/3700/2800/3800 series Cisco IOS voice gateways.
- This application note provides configuration guidelines for a toll-bypass network using Cisco IOS voice gateways to connect Avaya S8500 Communications Manager 2.1 PBXs. The PBXs are connected to the Cisco IOS voice gateways by E1 NET5 trunk circuits. The Cisco IOS voice gateways "extend" the E1 NET5 trunk circuits with VoIP, using the H.323 protocol.
- Two Avaya S8500 Communications Manager 2.1 PBXs were connected via E1 NET5 trunk to two Cisco IOS voice gateways. The voice gateways were connected via IP over Ethernet, and configured for VoIP using H.323. End-to-end calls were placed between the PBXs to exercise and test basic calls as well as NET5 supplementary services such as call hold, call transfer, call conference, and call forward.
- Using the Avaya PBX configurations and Cisco IOS voice gateway configurations in this application note, successful toll bypass integration was achieved. This includes basic call, call transfer, call conference, and call forward, and call hold, with some limitations on Caller ID features during transfer, forward, and conference scenarios. These limitations are detailed in the following sections and all were found to be inherent to the Avaya PBXs. Thus, H.323 toll bypass introduced no new restrictions to the available features or performance.

Network Topology

Figure 1. Network Topology or Test Setup



System Components

Hardware Requirements

- (2) Cisco IOS voice gateways with E1 VWICs (voice/WAN interface cards)
- (2) Avaya S8500s
- (4) Avaya digital station telephones

Software Requirements

- Avaya PBXs: Communications Manager Release 2.1
- Cisco IOS voice gateways: Cisco IOS Release Version 12.3(7)T or later.

Features

Features Supported

- Basic Call (ENBLOC and Overlap)
- Calling Name and Number [1]
- Connected Name and Number [1]
- Call Transfer: Supervised Local Transfer
- Call Transfer: Supervised Network/External Transfer
- Call Conference: Local
- Call Conference: Network/External
- Call Forward: Local
- Call Forward: Network/External
- Call Hold

Features Not Supported

- MWI

[1] Caller ID Name information is supported via a Display IE.

Limitations

- CONNECTED NAME and CONNECTED NUMBER are supported in lieu of CALLED (ALERTING) NAME and CALLED NUMBER. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 NET5 trunk.
- On Local Supervised Transfers, the original CALLING NAME and CALLING NUMBER are displayed on the final destination only after the transfer is complete. This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Network/External Supervised Transfers, the original CALLING NAME and CALLING NUMBER are not displayed on the final destination after the transfer is complete. Rather, the name and number of the transferring phone is still displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Supervised Transfers originated from an external call (e.g., Phone A calls Phone C, and Phone C transfers to Phone B), the CALLED (CONNECTED) NAME and NUMBER displays are not updated on the originating phone after the transfer is complete. Rather, the name and number of the transferring phone is still displayed. On Supervised Transfers originated from a local call (e.g., Phone A calls Phone B, and Phone B transfers to Phone C), however, the CONNECTED NAME and NUMBER displays are updated properly. This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Conference Calls accomplished by an external conference (e.g., originate from 'C' to 'A', and conference from 'A' to 'D'), the CALLING NAME and CALLING NUMBER are not passed to the remaining conferee when the conferencing extension drops out. The conferencing extension's Name/Number are displayed, or no name/number are displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Conference Calls accomplished by an external call followed by a local conference (e.g., originate call from 'C' to 'A', and conference from 'A' to 'B'), the Connected Name/Number are not updated on the original digital extension if the conferencing extension drops out. Rather, the conferencing extension's name/number are still displayed (e.g., 'A' Name/Number displayed on 'C'). This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Conference Calls originating from an external call followed by an external conference (e.g., originate from 'C' to 'A', and conference from 'A' to 'D' or originate from 'C' to 'A', and conference from 'C' to 'B'), the CALLING NAME and CALLING NUMBER are not passed to the remaining conferee when the conferencing extension drops out. The conferencing extension's information is still displayed, or no name and number are displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Conference Calls originating from an external call followed by an external conference (e.g., originate from 'C' to 'A', and conference from 'A' to 'D' or originate from 'C' to 'A', and conference from 'C' to 'B'), the CONNECTED NAME and NUMBER are not updated on the original calling extension when a conferee drops out. In cases where the conferencing extension drops, the conferencing extension's Name/Number are displayed on the originating extension. In cases where the originating extension is the conferencing extension, and another extension drops, there is no Connected Name/Number on the original/conferencing extension. Rather, the trunk number as defined in the originating phone's PBX is displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Conference Calls originating from a local call followed by an external conference (e.g., originate call from 'A' to 'B', and conference from 'B' to 'C'), the CALLING NAME and CALLING NUMBER are not passed to the remaining conferee ('C') when the conferencing extension ('B') drops out. The conferencing extension's information is still displayed (e.g., 'B' Name/Number displayed on 'C'). This is inherent to the PBXs and also occurs with the PBXs connected directly via a E1 NET5 trunk.
- On Forwarded Calls involving an external call followed by a local forward (e.g., originate from 'C' to 'B' and forward from 'B' to 'A'), the original CALLING NUMBER is not passed to the final destination extension. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 NET5 trunk.
- On all Forwarded Calls, the forwarding CALLED NUMBER is not passed to the final destination. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 NET5 trunk.
- On Forwarded Calls involving an external forward (e.g., originate from 'C' to 'B' and forward from 'B' to 'D'), the forwarding CALLED NAME is not passed to the final destination extension. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 NET5 trunk.
- On Forwarded Calls involving a local call followed by an external forward (e.g., originate from 'A' to 'B' and forward from 'B' to 'C'), the final destination CONNECTED NUMBER is not passed to the originating extension. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 NET5 trunk.

- MWI is not supported over Net5.

Configuration

Configuring the Avaya S8500 Communications Manager 2.1: Switch 1

Figure 2. Uniform Dial Plan screenshot

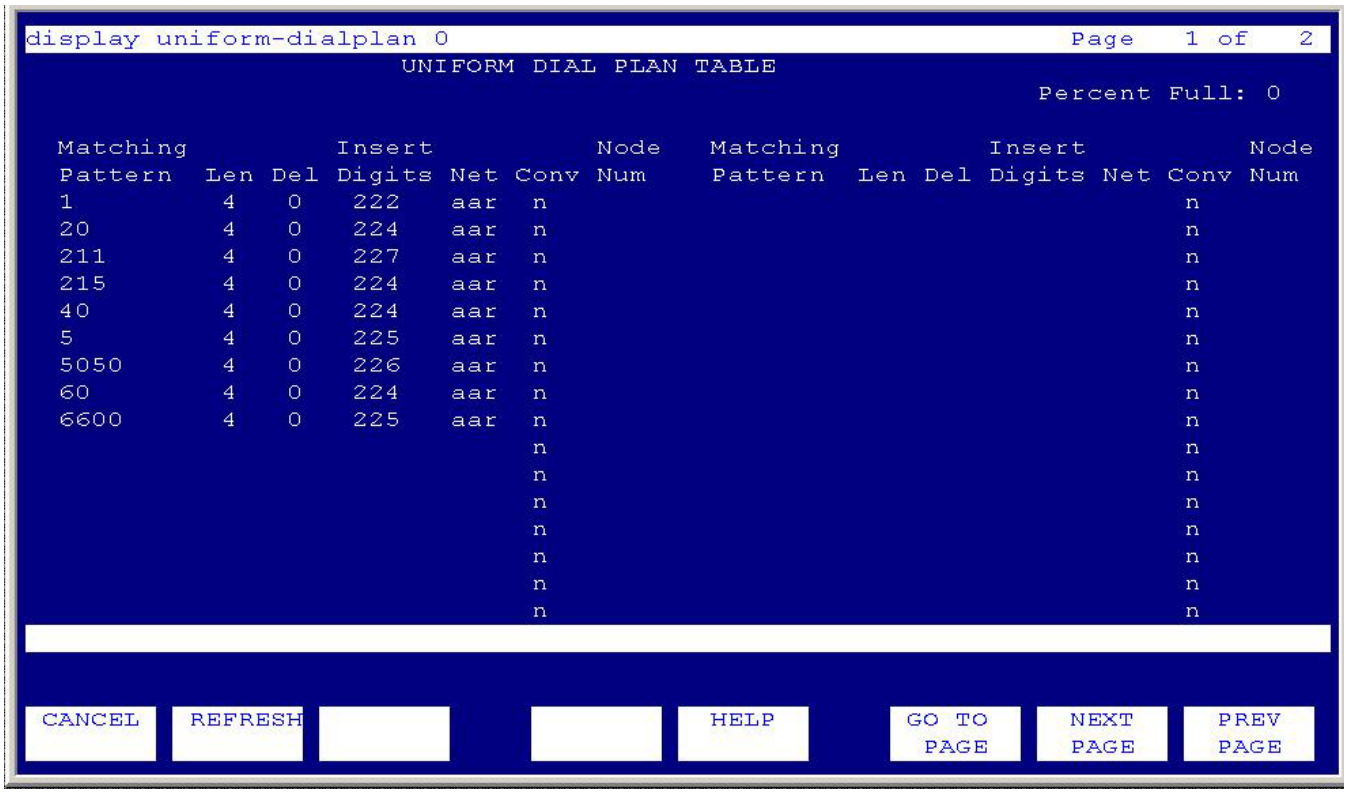


Figure 3. AAR Analysis screenshot

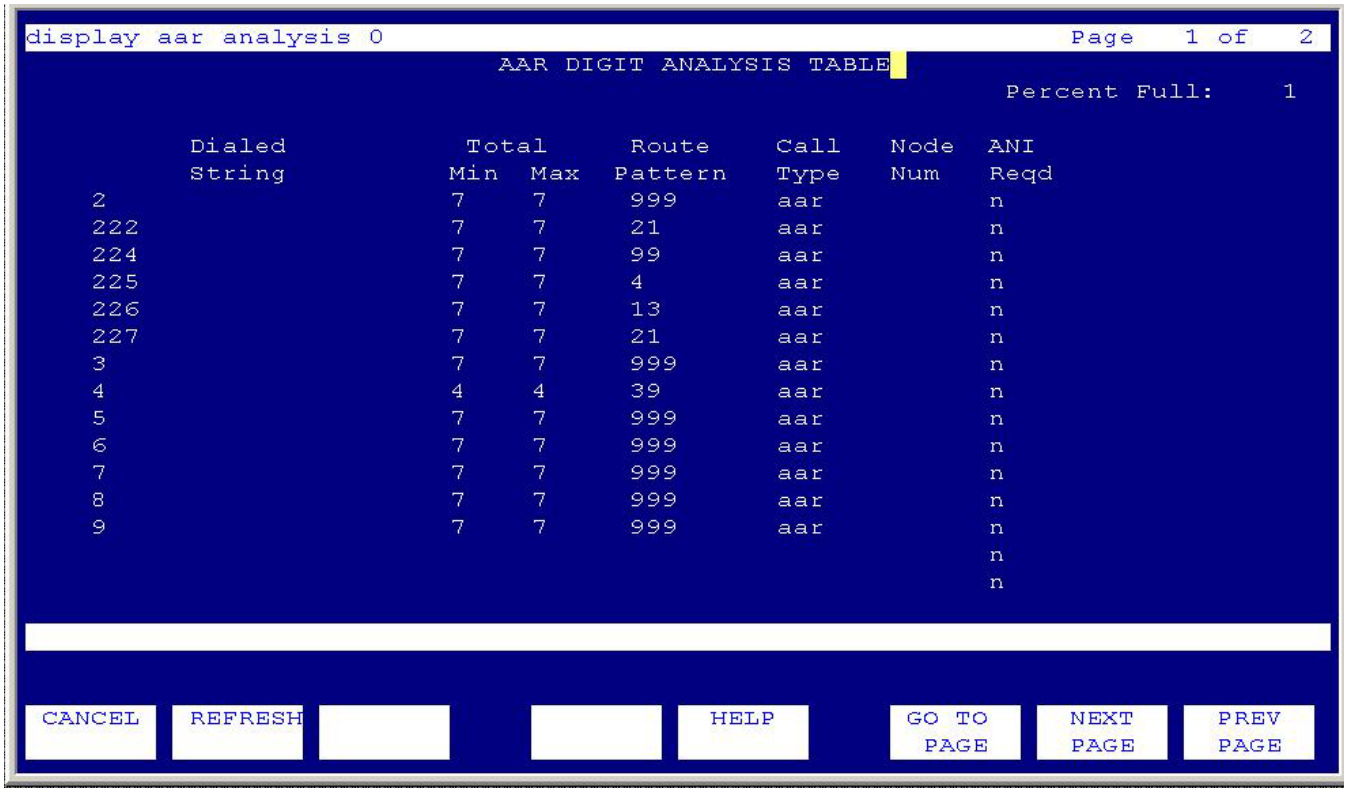


Figure 4. Designated Route Pattern (21) screenshot

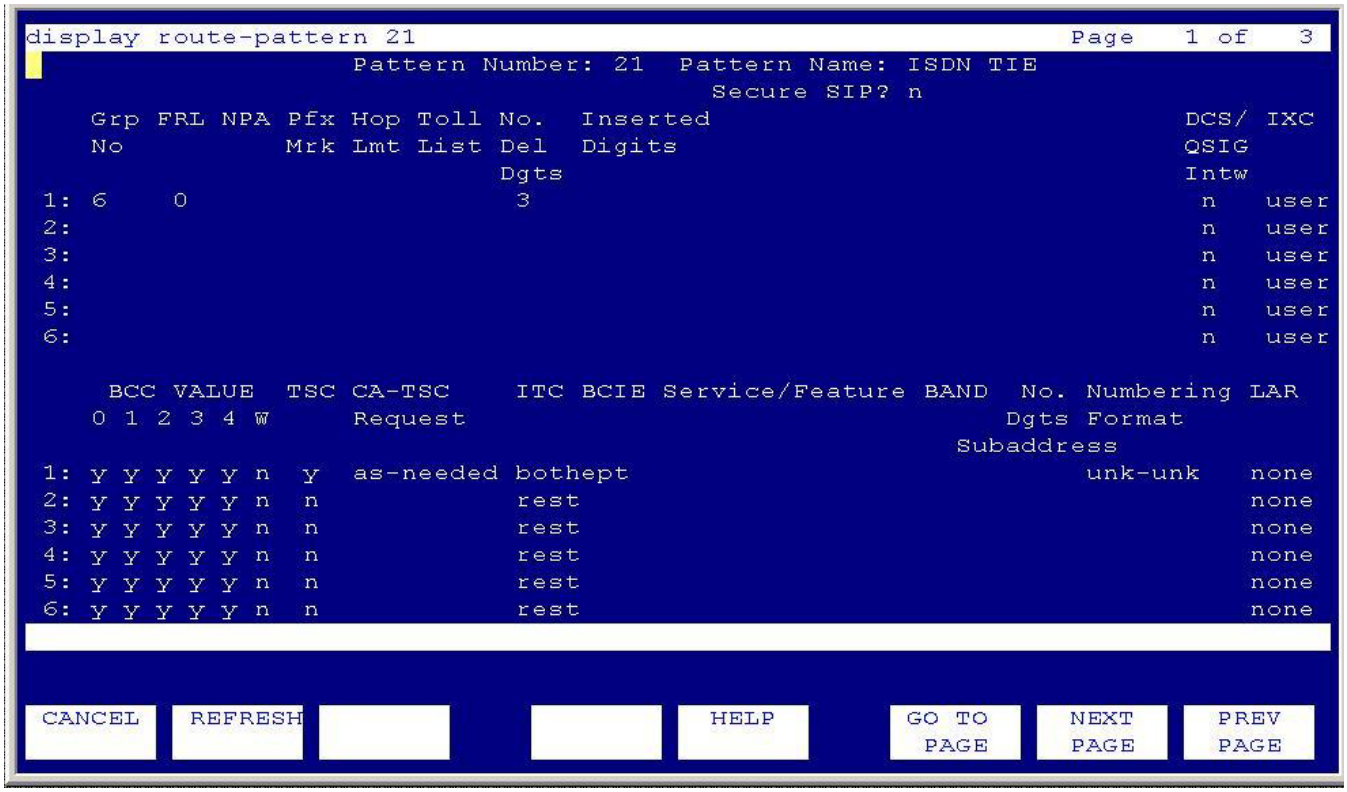


Figure 5. Route Patterns screenshot

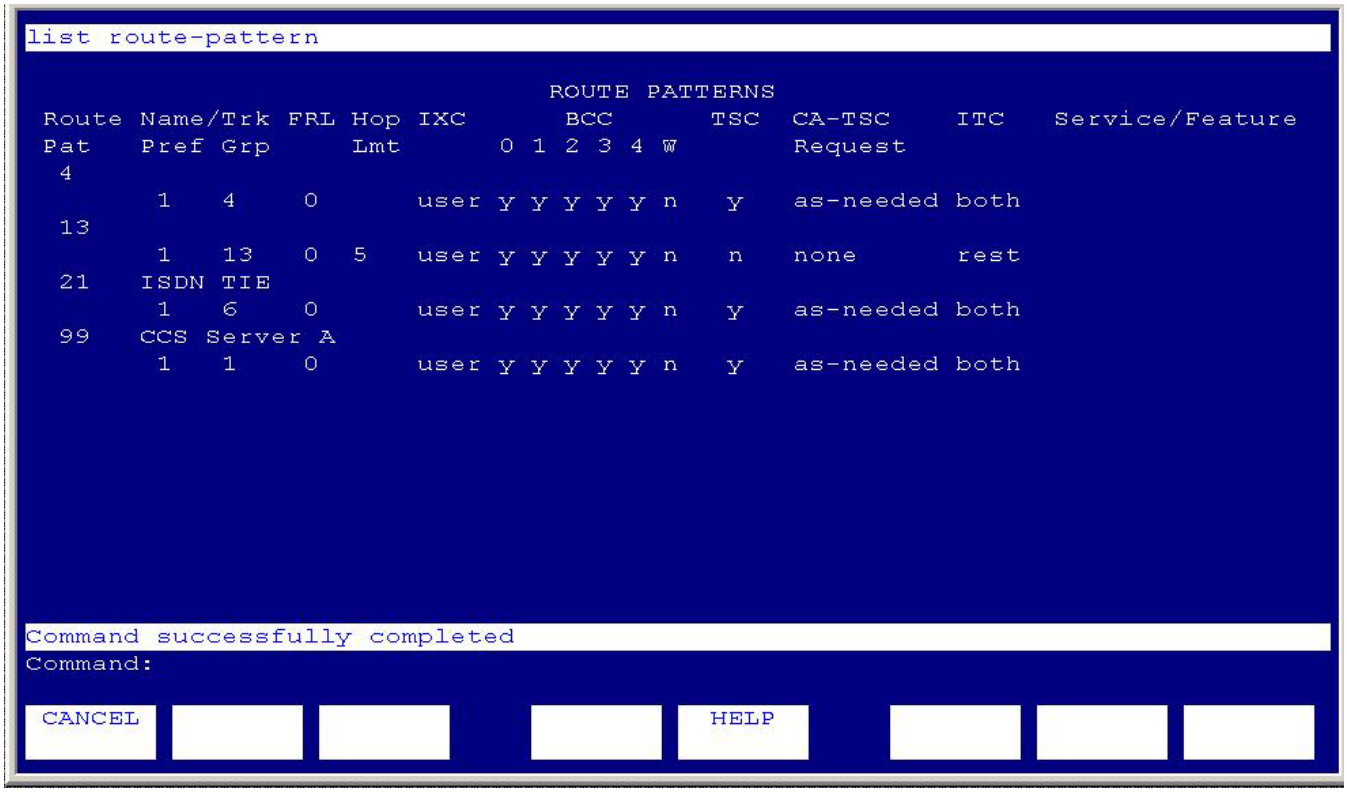


Figure 6. Signaling Group (6) screenshot

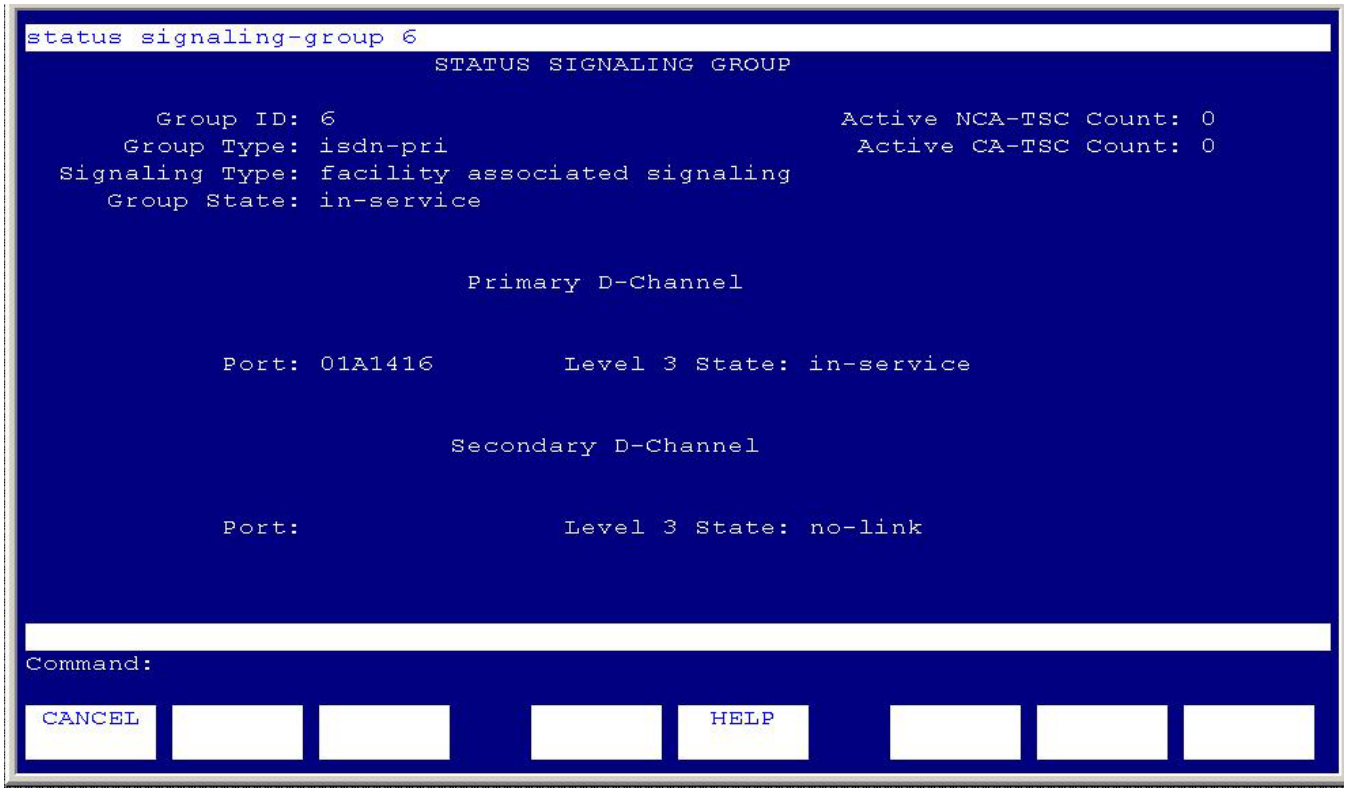


Figure 7. DS1 Board screenshot

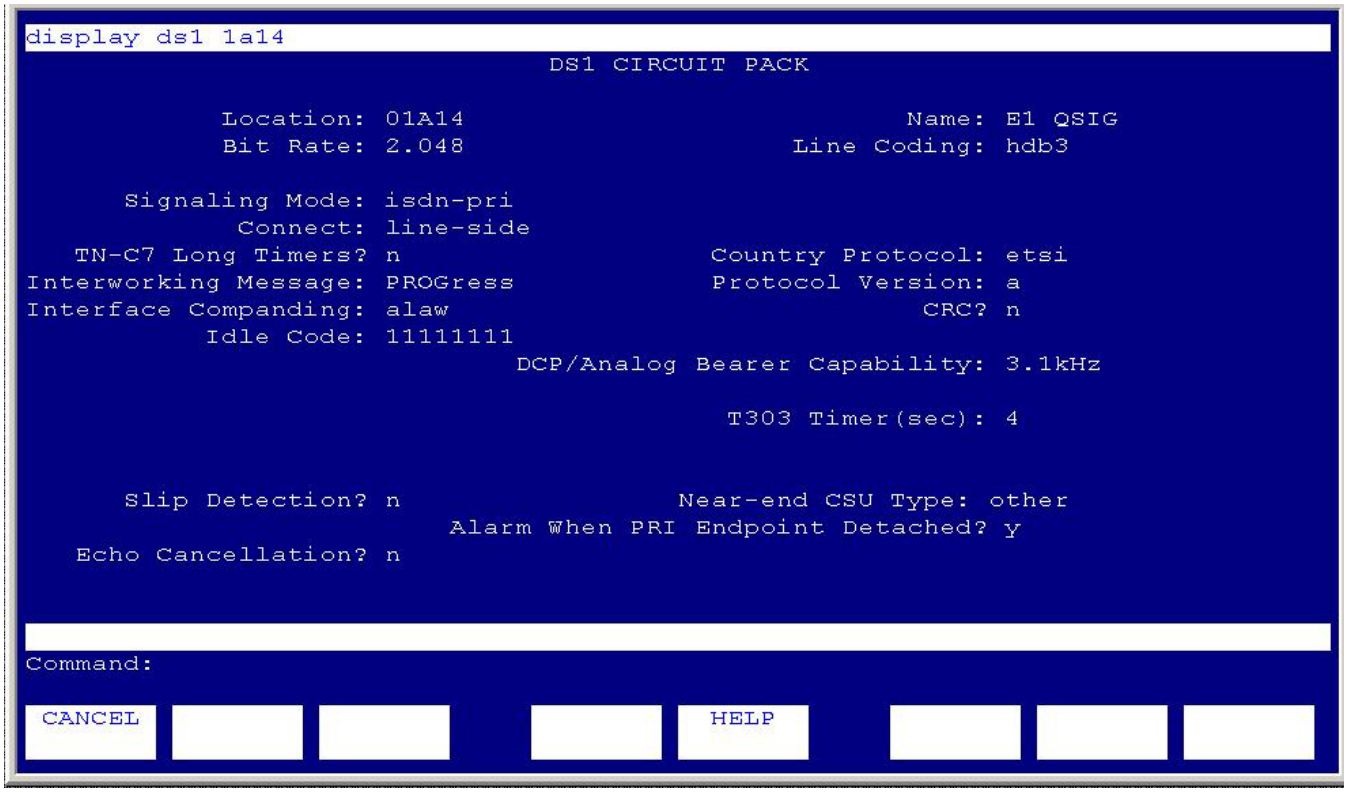


Figure 8. Trunks Status screenshot

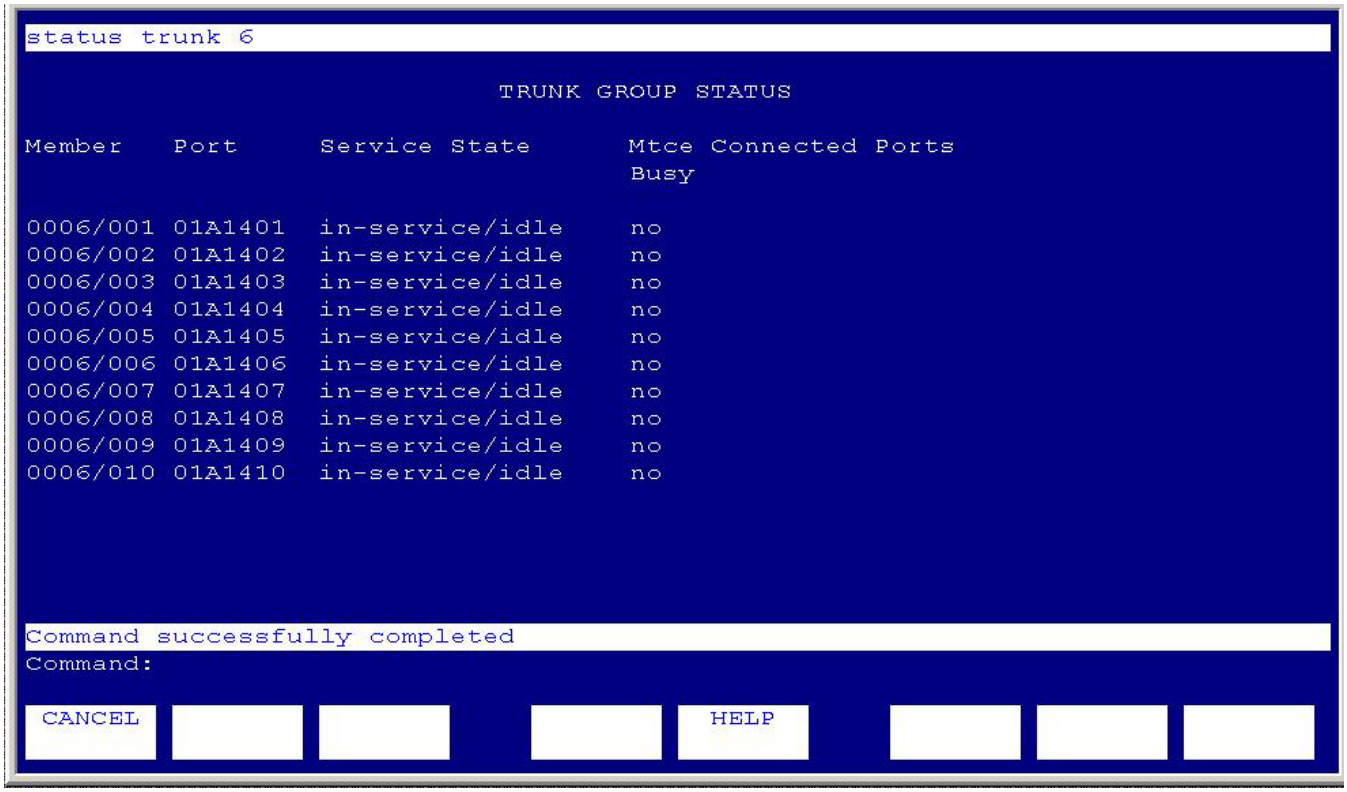


Figure 9. Uniform Dial Plan screenshot

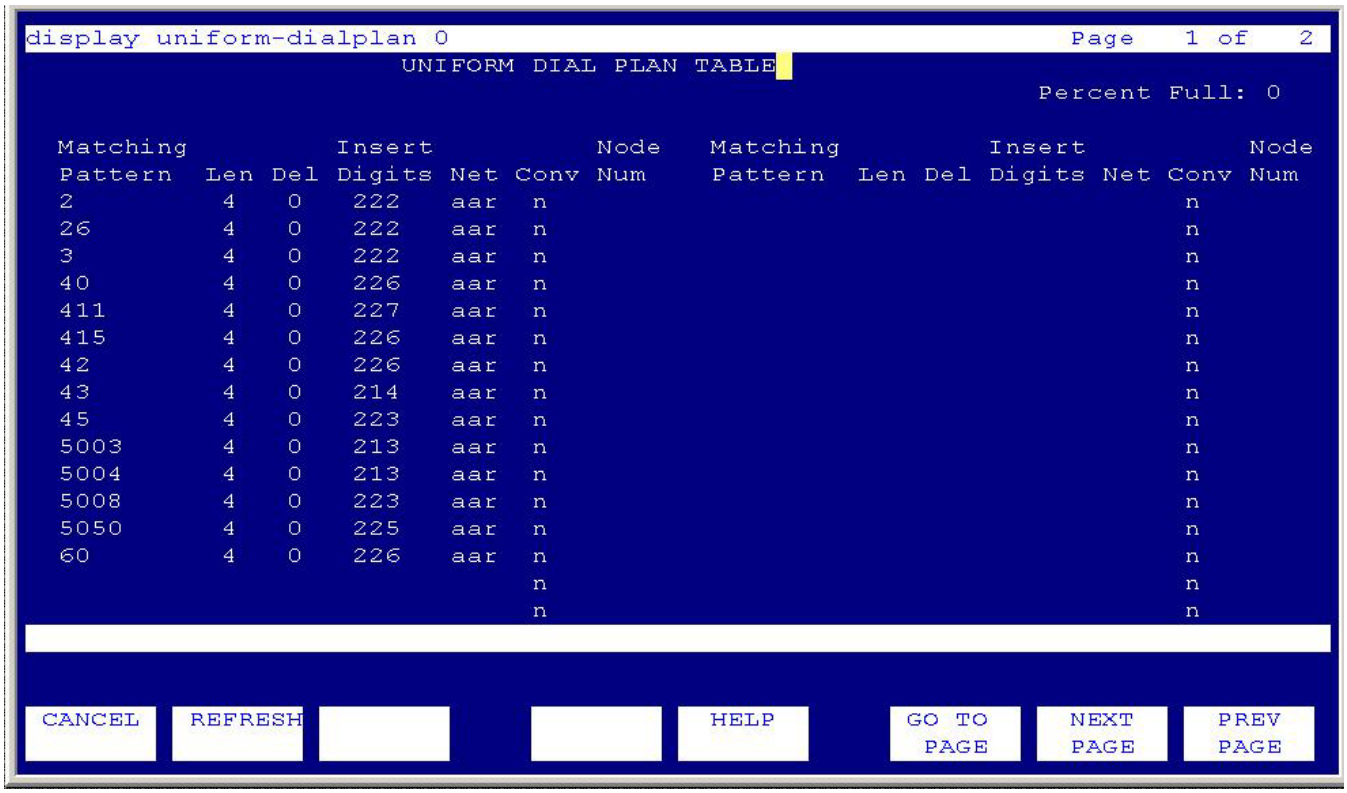
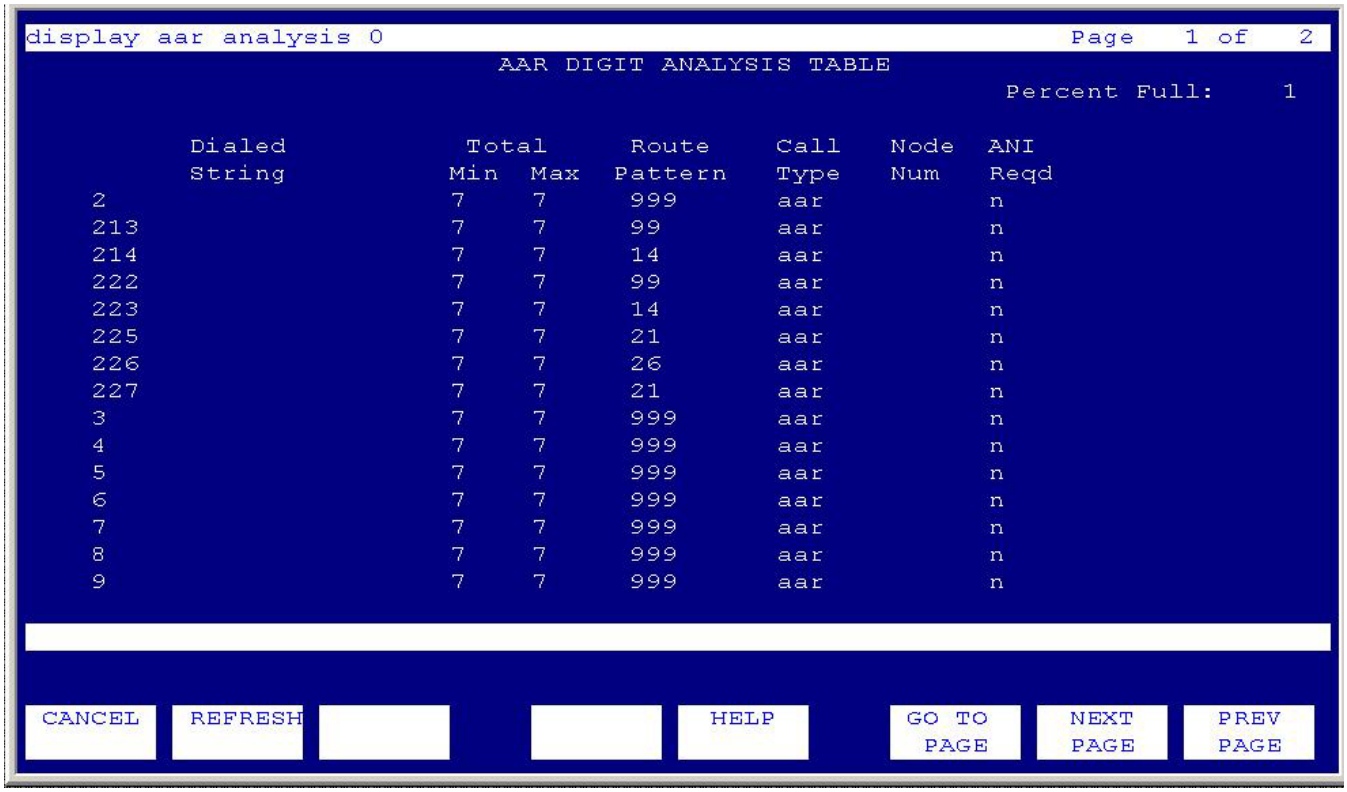


Figure 10. AAR Analysis screenshot



```
display aar analysis 0                                          Page   1 of   2
                          AAR DIGIT ANALYSIS TABLE
                                                          Percent Full:    1

        Dialed            Total      Route     Call    Node   ANI
        String          Min   Max    Pattern   Type    Num    Reqd
    2                   7     7      999       aar            n
    213                 7     7      99        aar            n
    214                 7     7      14        aar            n
    222                 7     7      99        aar            n
    223                 7     7      14        aar            n
    225                 7     7      21        aar            n
    226                 7     7      26        aar            n
    227                 7     7      21        aar            n
    3                   7     7      999       aar            n
    4                   7     7      999       aar            n
    5                   7     7      999       aar            n
    6                   7     7      999       aar            n
    7                   7     7      999       aar            n
    8                   7     7      999       aar            n
    9                   7     7      999       aar            n

 CANCEL  REFRESH                      HELP   GO TO PAGE  NEXT PAGE  PREV PAGE
```

Figure 11. Designated Route Pattern (21) screenshot

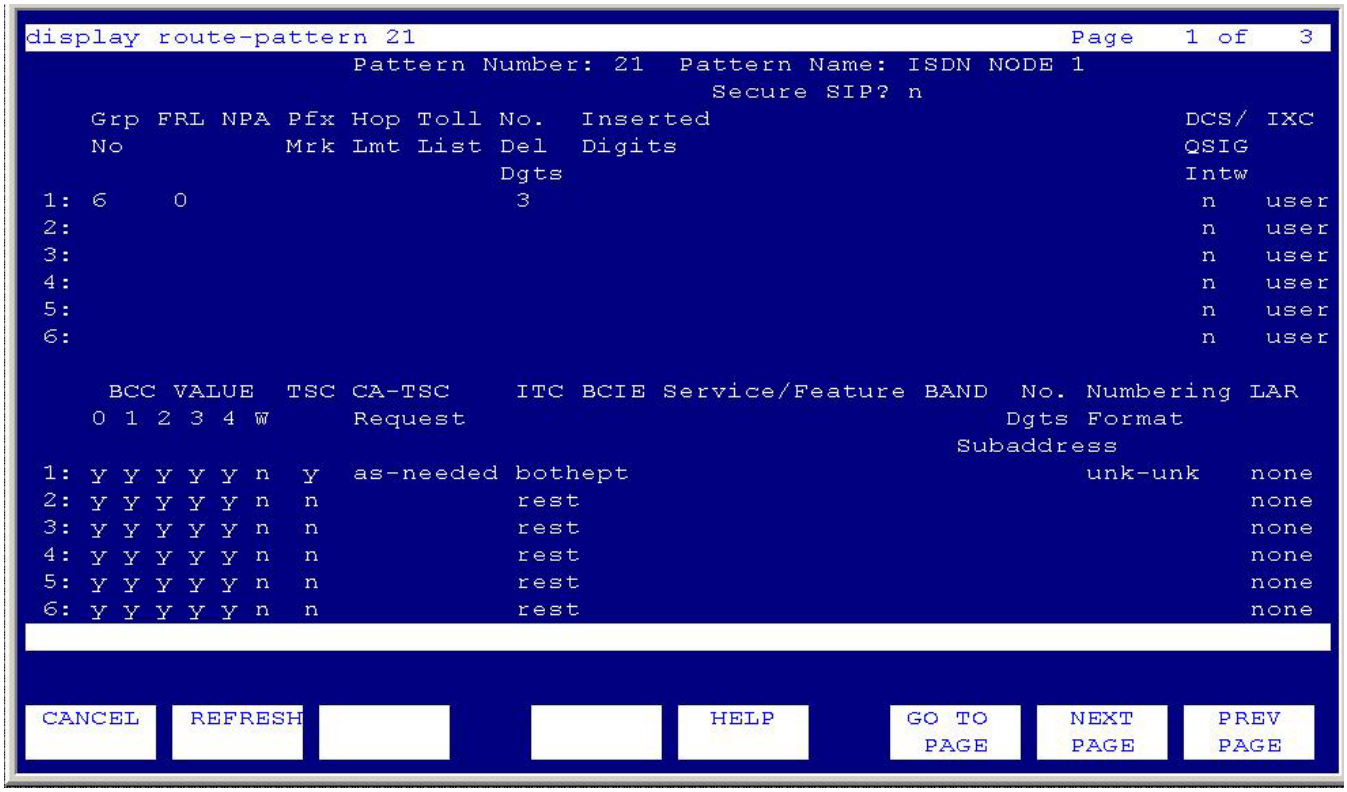


Figure 12. Route Patterns screenshot

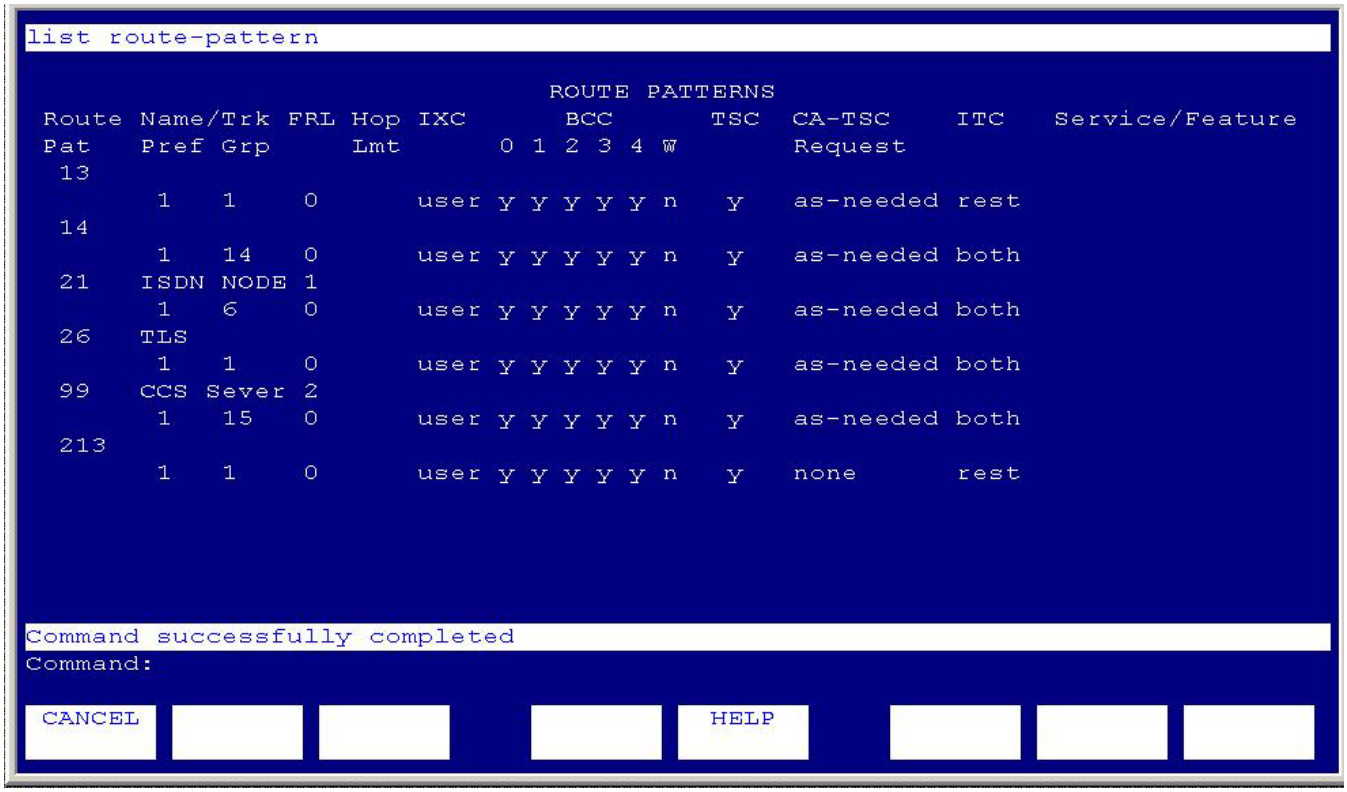


Figure 13. Signaling Group (6) screenshot

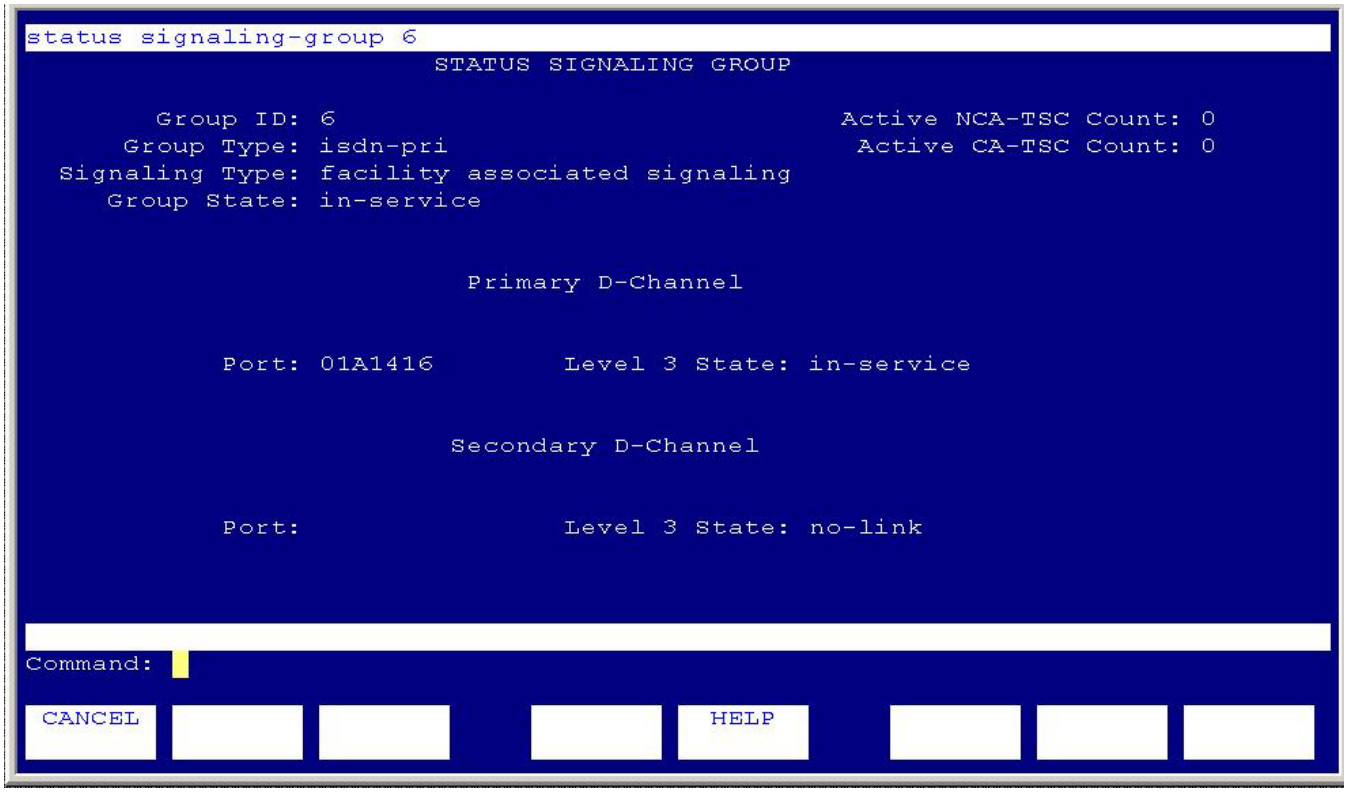


Figure 14. DS1 Board screenshot

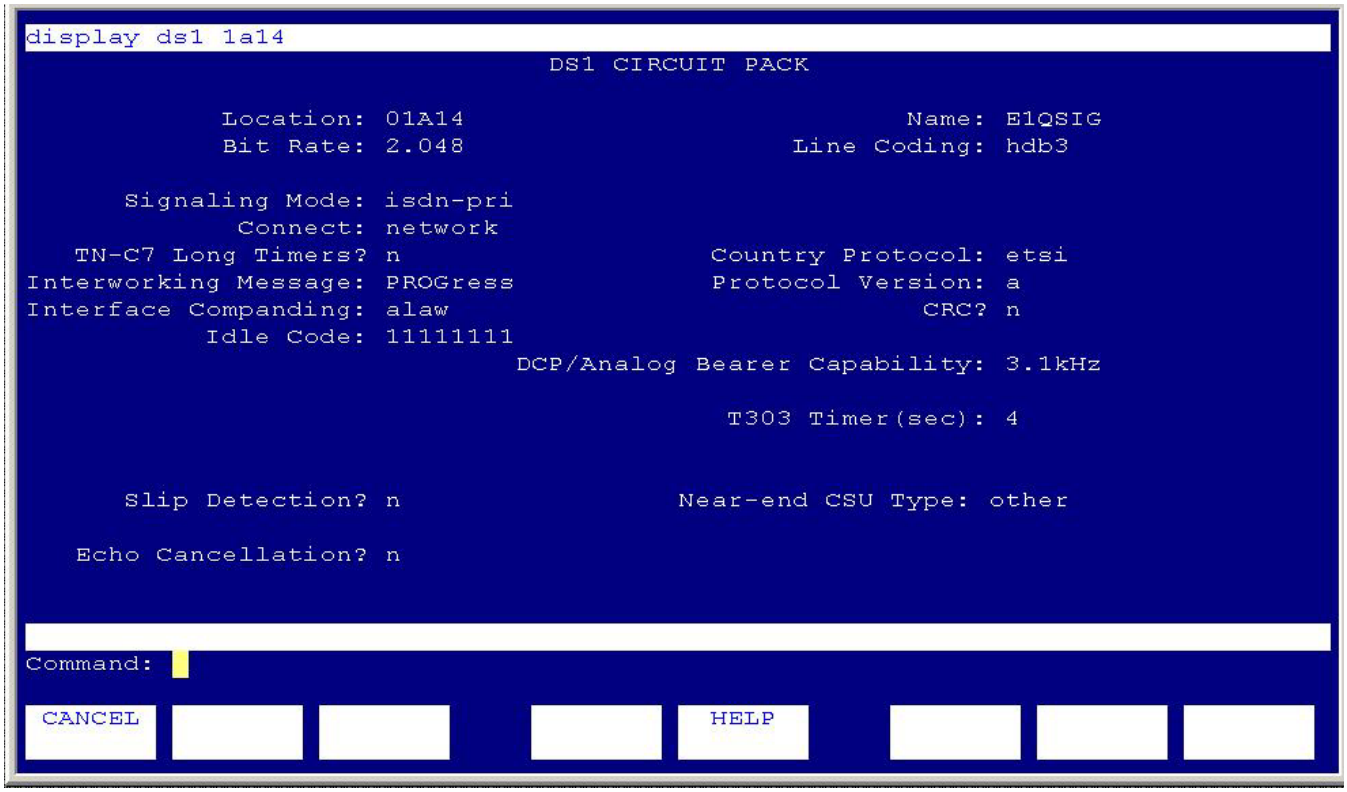
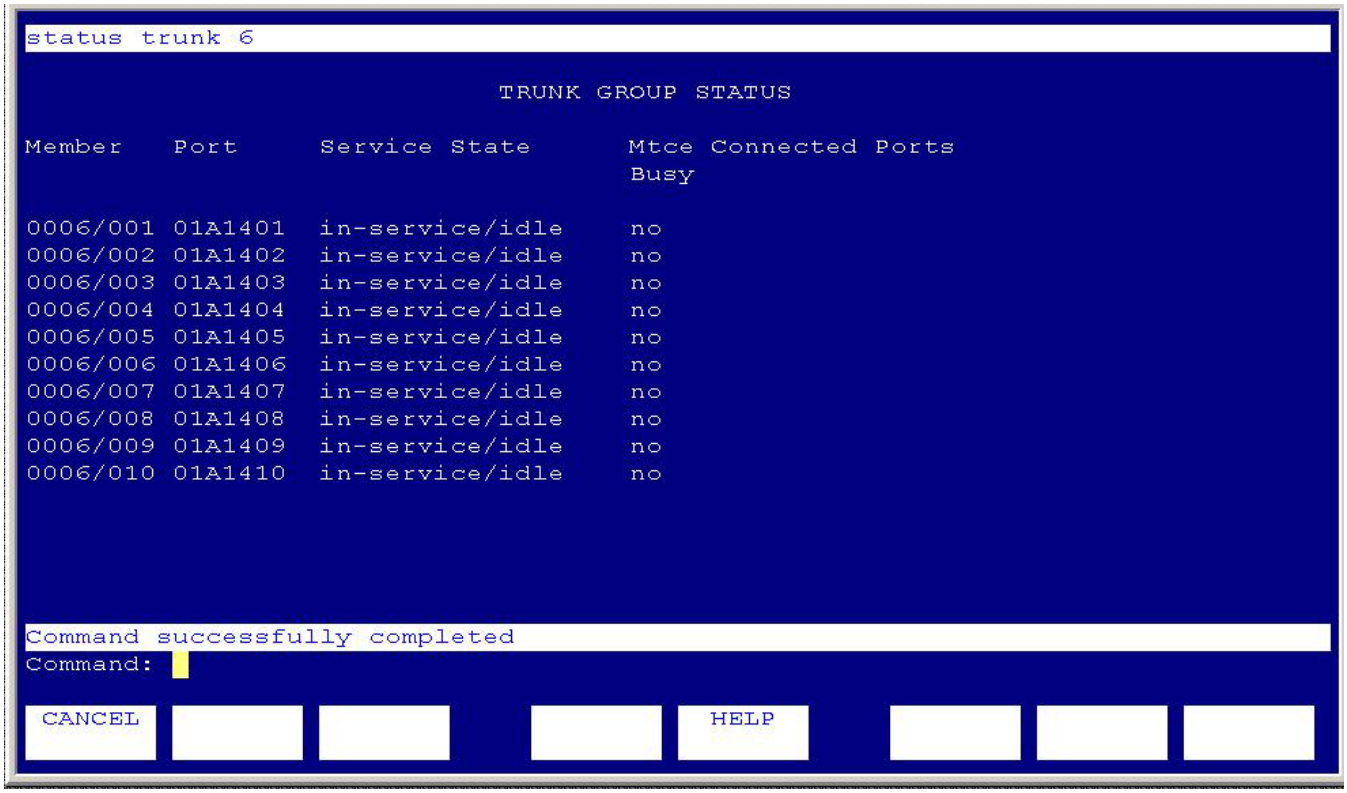


Figure 15. Trunks Status screenshot



Configuring the Cisco IOS Voice Gateway 'A' (Cisco 2651XM)

2651XM_West#sho ver

Cisco IOS Software, C2600 Software (C2600-ADVENTERPRISEK9-M), Version 12.3(7)T,

RELEASE SOFTWARE (fc1)

Technical Support: http://www.cisco.com/techsupport

Copyright (c) 1986-2004 by Cisco Systems, Inc.

Compiled Sat 21-Feb-04 14:41 by eaarmas

ROM: System Bootstrap, Version 12.2(8r) [cmong 8r], RELEASE SOFTWARE (fc1)

2651XM_West uptime is 3 hours, 6 minutes

System returned to ROM by reload

System image file is "flash:c2600-adventerprisek9-mz.123-7.T.bin"

Cisco 2651XM (MPC860P) processor (revision 0x300) with 124928K/6144K bytes of memory.

Processor board ID JAE0817EK5Z (1672255744)

M860 processor: part number 5, mask 2

2 FastEthernet interfaces

31 Serial interfaces

2 Channelized E1/PRI ports

32K bytes of NVRAM.

49152K bytes of processor board System flash (Read/Write)

Configuration register is 0x2102

2651XM_West#sho running-config

Building configuration...

Current configuration : 1976 bytes

!

version 12.3

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname 2651XM_West

!

boot-start-marker

boot system flash

boot-end-marker

!

!

no network-clock-participate slot 1

no network-clock-participate wic 0

voice-card 1

!

ip subnet-zero

!

!

ip cef

no ip domain lookup

ip audit po max-events 100

no aaa new-model

```
no ftp-server write-enable
isdn switch-type primary-net5
!
!
!
voice service voip
 h323
!
!
voice class codec 1
 codec preference 1 g729r8
 codec preference 2 g711ulaw
 codec preference 3 g711alaw
!
!
controller E1 1/0
 framing NO-CRC4
 pri-group timeslots 1-31
 description ECN-4
!
controller E1 1/1
!
no crypto isakmp enable
!
!
interface FastEthernet0/0
 ip address 172.20.4.7 255.255.255.0
 duplex auto
 speed auto
```

```
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial1/0:15
 description D-channel for ECN-4
 no ip address
 no logging event link-status
 isdn switch-type primary-net5
 isdn overlap-receiving
 isdn incoming-voice voice
 isdn send-alerting
 isdn bchan-number-order ascending
 isdn sending-complete
 isdn outgoing display-ie
 no cdp enable
!
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
!
ip http server
no ip http secure-server
!
!
control-plane
!
```

```
!
!
voice-port 1/0:15
 description voice port for ECN-4
!
!
dial-peer voice 323 voip
 destination-pattern 2...
 session target ipv4:172.20.4.9
!
dial-peer voice 1015 pots
 destination-pattern 4...
 direct-inward-dial
 port 1/0:15
 forward-digits all
!
dial-peer voice 519 voip
 shutdown
 destination-pattern 6...
 session protocol sipv2
 session target ipv4:172.20.4.9
 supplementary-service pass-through
!
dial-peer voice 5050 pots
 destination-pattern 5050
 direct-inward-dial
 port 1/0:15
 forward-digits all
!
```

```
!
!
line con 0
line aux 0
line vty 0 4
 exec-timeout 0 0
 password cisco
 login
 transport input telnet
!
!
!
end


2651XM_West#sho isdn stat
Global ISDN Switchtype = primary-net5
ISDN Serial1/0:15 interface
        dsl 0, interface ISDN Switchtype = primary-net5
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
    Active dsl 0 CCBs = 0
    The Free Channel Mask:  0xFFFF7FFF
    Number of L2 Discards = 0, L2 Session ID = 1
    Total Allocated ISDN CCBs = 0
2651XM_West#
```

Configuring the Cisco IOS Voice Gateway 'B' (Cisco 3745)

#3745_West#sho ver

Cisco IOS Software, 3700 Software (C3745-ADVENTERPRISEK9-M), Version 12.3(7)T, R

ELEASE SOFTWARE (fc1)

Technical Support: http://www.cisco.com/techsupport

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Compiled Sat 21-Feb-04 05:53 by eaarmas

ROM: System Bootstrap, Version 12.2(8r)T2, RELEASE SOFTWARE (fc1)

3745_West uptime is 3 hours, 9 minutes

System returned to ROM by reload

System image file is "flash:c3745-adventerprisek9-mz.123-7.T.bin"

Cisco 3745 (R7000) processor (revision 2.0) with 116736K/14336K bytes of memory.

Processor board ID JMX0813L0Z3

R7000 CPU at 350MHz, Implementation 39, Rev 3.3, 256KB L2, 2048KB L3 Cache

2 FastEthernet interfaces

31 Serial interfaces

4 Channelized E1/PRI ports

2 Voice FXS interfaces

DRAM configuration is 64 bits wide with parity disabled.

151K bytes of NVRAM.

31168K bytes of ATA System CompactFlash (Read/Write)

Configuration register is 0x2102

3745_West#sho run

3745_West#sho running-config

Building configuration...

Current configuration : 2404 bytes

!

version 12.3

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname 3745_West

!

boot-start-marker

boot system flash

boot-end-marker

!

card type e1 1 1

logging buffered 5000000 debugging

!

no network-clock-participate slot 1

no network-clock-participate slot 2

no network-clock-participate slot 3

no network-clock-participate slot 4

no network-clock-participate wic 0

no network-clock-participate wic 1

no network-clock-participate wic 2

no network-clock-participate aim 0

```
no network-clock-participate aim 1
no aaa new-model
ip subnet-zero
ip cef
!
!
no ip domain lookup
ip audit po max-events 100
no ftp-server write-enable
isdn switch-type primary-net5
voice-card 1
 dspfarm
!
!
voice call carrier capacity active
!
voice service voip
 h323
!
!
voice class codec 1
 codec preference 2 g711ulaw
 codec preference 3 g711alaw
!
!
controller E1 1/0
 framing NO-CRC4
 pri-group timeslots 1-31
 description ECN10
```

```
!
controller E1 1/1
!
controller E1 1/2
!
controller E1 1/3
!
no crypto isakmp enable
!
!
interface FastEthernet0/0
 ip address 172.20.4.9 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial1/0:15
 description D-channel for ECN10
 no ip address
 no logging event link-status
 isdn switch-type primary-net5
 isdn overlap-receiving
 isdn protocol-emulate network
 isdn incoming-voice voice
```

```
 isdn send-alerting
 isdn sending-complete
 no cdp enable
!
router eigrp 10
 network 172.20.0.0
 no auto-summary
!
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
!
ip http server
no ip http secure-server
!
!
control-plane
!
!
!
voice-port 1/0:15
 description voice port for ECN10
!
voice-port 3/0/0
!
voice-port 3/0/1
!
!
dial-peer cor custom
!
```

```
!
!
dial-peer voice 323 voip
 destination-pattern 4...
 session target ipv4:172.20.4.7
!
dial-peer voice 1015 pots
 destination-pattern 2...
 direct-inward-dial
 port 1/0:15
 forward-digits all
!
dial-peer voice 519 voip
 shutdown
 destination-pattern 3...
 session protocol sipv2
 session target ipv4:172.20.4.7
 supplementary-service pass-through
!
dial-peer voice 5050 voip
 destination-pattern 5050
 session target ipv4:172.20.4.7
!
!
!
line con 0
line aux 0
line vty 0 4
 exec-timeout 0 0
```

```
 password cisco
 login
 transport input telnet
!
!
end


3745_West#sho isdn stat
Global ISDN Switchtype = primary-net5
ISDN Serial1/0:15 interface
        ******* Network side configuration *******
        dsl 0, interface ISDN Switchtype = primary-net5
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
    Active dsl 0 CCBs = 0
    The Free Channel Mask:  0xFFFF7FFF
    Number of L2 Discards = 0, L2 Session ID = 1
    Total Allocated ISDN CCBs = 0
3745_West#
```

Acronyms

Acronym	Definitions

Important Information

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