Nortel Meridian Opt11C Rel 25 PBX with CallManager using the Cisco 2621-T1 PRI NI-2 Gateway

This application note discusses the integration of the Nortel Meridian Opt11C Rel 25 PBX with CallManager using the Cisco 2621-T1 PRI NI-2 Gateway.

Integration Description

Connectivity is achieved by using the industry standard PRI NI-2 protocol. The Nortel Meridian Opt11C can be configured as either the NETWORK or USER side. The figure below shows the general network layout for the integration.
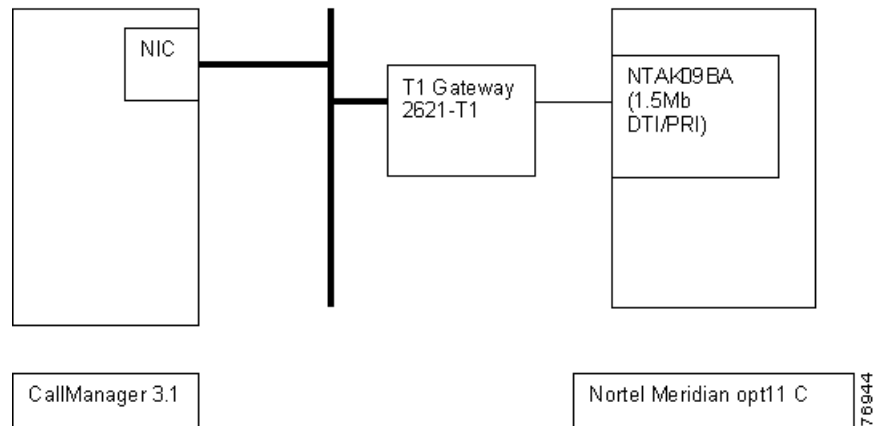
Features

Key features supported:

- Calling/Called Number

Key features not supported:

- Calling/Called Name

Network Layout

Cisco Systems Equipment Needed

- Hardware (Gateway): Cisco 2621 2 MFT T1 Port
- Software: CallManager Release 3.1

PBX Requirements

- Hardware: NTAK09BA, 1.5 Mb DTI/PRI, Release 02
- Software: Release 25

Configuring the Nortel Meridian Opt11C PBX

To configure the Nortel Meridian Opt11C PBX, do the following:

Step 1. Configure the common equipment.

Step 2. Configure the D-channel.

Step 3. Configure the Route Data Block.

Step 4. Configure the trunk.

Step 5. Configure the coordinated dialing plan.

Configure the Common Equipment

The following example shows the configuration of the common equipment.

Common Equipment Configuration

```
LD 22

PT2000
MARP NOT ACTIVATED


REQ  PRT
TYPE CEQU

CEQU
  MPED 8D
  SUPL  000  004  008  012
        016  032  036  040
        044  048  064  068
        072
  XCT   000
  CONF  029  030  031  062
        094  095

  DLOP  NUM DCH FRM LCMT YALM T1TE TRSH
   PRI  004 23  ESF B8S  FDL  -    00
        005 23  ESF B8S  FDL  -    00
  MISP

REQ  ****
```

Configure the D-Channel

The following example shows the configuration of the D-channel.

D-channel Configuration

```
>LD 22

PT2000
MARP NOT ACTIVATED


REQ  PRT
TYPE ADAN DCH 5

ADAN     DCH 5
  CTYP MSDL
  CARD 05
  PORT 1
  DES  DMS-100
  USR  PRI
  DCHL 5
  OTBF 32
  PARM RS422  DTE
  DRAT 64KC
  CLOK EXT
  IFC  D100
  SIDE USR
  CNEG 1
  RLS  ID  **
  RCAP ND2
  MBGA NO
  OVLR NO
  OVLS NO
  T200 3
  T203 10
  N200 3
  N201 260
  K    7

REQ  ****
```

Configure the Route Data Block

The following example shows the configuration of the Route Data Block.

Route Data Block Configuration

```
>LD 21
PT1000

REQ: PRT
TYPE: RDB
CUST 0
ROUT 105

TYPE RDB
CUST 00
DMOD
ROUT 105
DES  NI2
TKTP DID
M911_ANI  NO
M911_TONE  NO
NPID_TBL_NUM  0
SAT  NO
RCLS EXT
DTRK YES
BRIP NO
DGTP PRI
ISDN YES
    MODE PRA
    IFC  NI2
    CBCR NO
    NCOS 0
    SBN  NO
    PNI  00001
    NCNA YES
    NCRD YES
    CHTY BCH
    CPFXS YES
    CPUB OFF
    DAPC NO
    BCOT 0
    INTC NO
DSEL VOD
PTYP PRI
AUTO NO
DNIS NO
DCDR NO
ICOG IAO
RANX NO
SRCH RRB
TRMB YES
STEP
ACOD 705
TCPP NO
PII NO
TARG 01
CLEN 1
```

```
BILN NO
OABS
INST
ICIS YES
TIMR ICF 512
     OGF 512
     EOD 13952
     NRD 10112
     DDL 70
     ODT 4096
     RGV 640
     FLH 510
     GRD 896
     SFB 3
     NBS 2048
     NBL 4096
     TFD 0
DRNG NO
CDR  NO


PAGE 002

MUS  NO
EQAR NO
OHQ  NO
OHQT 00
TTBL 0
PLEV 2
MCTS NO
ALRM NO
ART  0
SGRP 0
AACR NO

REQ: ****
```

Configure the Trunk

The following example shows the configuration of the trunk.

Trunk Configuration
```
>LD 20

PT0000
MARP NOT ACTIVATED

REQ: PRT
TYPE: TNB
TN    5 1
DTC103

DATE
PAGE
DES

TN    005 01
TYPE DID
CDEN SD
CUST 0
TRK  PRI
PDCA 1
PCML MU
NCOS 0
RTMB 105 1
B-CHANNEL SIGNALING
NITE
STRI/STRO OWK OWK
AST  NO
IAPG 0
CLS  UNR DTN CND WTA LPR APN THFD HKD
     P10 VNL
TKID
DATE  8 MAR 2001

NACT ****
```

Configure the Coordinated Dialing Plan

The following example shows the configuration of the coordinated dialing plan.

Coordinated Dialing Plan Configuration

```
>LD 87
ESN000

MEM AVAIL: (U/P): 1302848    USED U P: 62313 27478    TOT: 1392639
DISK RECS AVAIL: 491
REQ  PRT
CUST 0
FEAT CDP
TYPE DSC
DSC  50
DSC  50
FLEN 0
DSP  LSC
RLI  5
NPA
NXX


MEM AVAIL: (U/P): 1302848    USED U P: 62313 27478    TOT: 1392639
DISK RECS AVAIL: 491
REQ  ****


>
OVL000

>LD 86
ESN000

MEM AVAIL: (U/P): 1302848    USED U P: 62313 27478    TOT: 1392639
DISK RECS AVAIL: 491
REQ  PRT
CUST 0
FEAT RLB
RLI  5

RLI  5
ENTR 0
LTER NO
ROUT 105
TOD  0 ON  1 ON  2 ON  3 ON
     4 ON  5 ON  6 ON  7 ON
CNV  NO
EXP  NO
FRL  0
DMI  0
FCI  0
FSNI 0
SBOC NRR
OHQ  NO
CBQ  NO

ISET 0
```

```
NALT 5
MFRL 0
OVLL 0


MEM AVAIL: (U/P): 1302848    USED U P: 62313 27478    TOT: 1392639
DISK RECS AVAIL: 491
REQ  ****
```

Configuring Cisco CallManager

To configure Cisco CallManager, do the following:

Step 1.   Configure the gateway.

Step 2.   Configure the route pattern.

Gateway Configuration

The following figures show the configuration of the Cisco 2621 Gateway.

Cisco 2621 Gateway Configuration

Cisco 2621 Gateway Configuration Continued

Cisco 2621 Gateway Configuration Continued
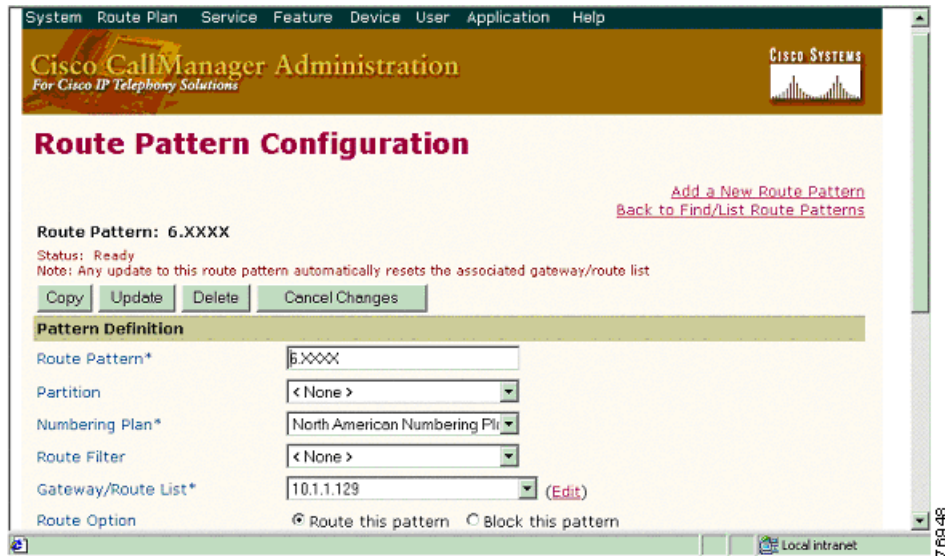
Route Pattern Configuration

The following figures show the configuration of the route pattern.

Route Pattern Configuration

Route Pattern Configuration Continued

Considerations

User/Network Settings

The Cisco 2621 router with ISDN switch type setting of primary-ni supports both protocol sides using the **isdn protocol-emulate network/user** command. When the router is set to emulate the Network side and the Nortel trunk type is set for DID, the Nortel must send at least 10 digits for the router to properly route the call. Otherwise, the Cisco 2621 router sends back a release message containing a release cause of "Invalid Number Format."

Calling Name and Number Feature

Calling Name delivery and presentation features are not supported by the Nortel PBX as of Release 25. The only switch-types available on the Nortel with calling name delivery/presentation feature are QSIG with GF platform (i.e. ESGF, ISGF and E4GF) and DMS100.

When calling from a Cisco 7960 IP phone to a Nortel digital phone, the Calling/Called Number is displayed on both phones after the call is answered as expected.

When calling from a Nortel digital phone to a Cisco 7960 IP phone, the IP phone displays the Connected Number after the call is answered. The Nortel phone, however, is not updated when the call is answered. It displays the numbers being dialed instead. (the access code and the extension number). It was verified using ISDN protocol analyzer that the CallManager was not sending "Connected Number" information in the CONNECT message back to PBX.

Integration Testing

This section contains information about the setup used in testing the integration of the Nortel Meridian Opt11C Release 25 PBX and the Cisco 2621-T1 PRI NI-2 Gateway.

CallManager Software Release:

The following figure shows the information about the release of CallManager being used.

CallManager Software Release
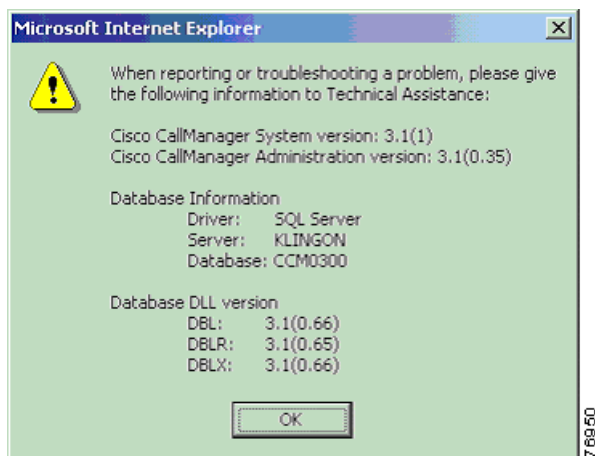
Nortel Meridian Opt11C Software Release

The following provides information about the release of the Nortel Meridian Opt11C used.

Software Release

```
>LD 22
PT2000
MARP NOT ACTIVATED


REQ  ISS

VERSION 2111
RELEASE 25
ISSUE 15 +
PSWV VERSION: PSWV 33



REQ
DTC103
****
```

Software Packages Installed (Release 25)

```
>LD 22
PT2000
MARP NOT ACTIVATED


REQ  PRT
TYPE PKG
OPTF   1
CUST   2
CDR    4
CTY    5
RAN    7
TAD    8
DNDI   9
EES   10
INTR  11
ANI   12
ANIR  13
BRTE  14
DNDG  16
MSB   17
SS25  18
DDSP  19
ODAS  20
DI    21
CHG   23
CAB   24
BAUT  25
CASM  26
CASR  27
BQUE  28
NTRF  29
```

```
NCOS    32
CPRK    33
SSC     34
IMS     35
UST     35
UMG     35
ROA     36
NSIG    37
MCBQ    38
NSC     39
BACD    40
ACDB    41
ACDC    42
LMAN    43
MUS     44
ACDA    45
MWC     46
AAB     47
GRP     48
NFCR    49
ACDD    50
LNK     51
FCA     52
SR      53
AA      54
HIST    55
AOP     56
BARS    57
NARS    58
CDP     59
PQUE    60
FCBQ    61
OHQ     62
NAUT    63
SNR     64


PAGE 001

NXFR    67
HOT     70
DHLD    71
LSEL    72
SS5     73
DRNG    74
PBXI    75
DLDN    76
CSL     77
OOD     79
SCI     80
CCOS    81
CDRQ    83
TENS    86
FTDS    87
DSET    88
TSET    89
```

```
LNR     90
DLT2    91
PXLT    92
SUPV    93
CPND    95
DNIS    98
BGD     99
RMS     100
MR      101
AWU     102
PMSI    103
LLC     105
MCT     107
ICDR    108
APL     109
TVS     110
TOF     111
IDC     113
AUXS    114
DCP     115
PAGT    116
CBC     117
CCDR    118
EMUS    119
SCMP    121
FTC     125
BKI     127
DTI2    129
TBAR    132
ENS     133
FFC     139
DCON    140
MPO     141
ISDN    145
PRA     146
ISL     147
NTWK    148
IEC     149
DNXP    150
CDRE    151
IAP3P   153
PRI2    154
ACNT    155
THF     157


PAGE 002

FGD     158
FNP     160
ISDN INTL SUP  161
SAR     162
LAPW    164
GPRI    167
ARIE    170
CPGS    172
```

```
ECCS    173
AAA     174
NMS     175
EOVF    178
HVS     179
DKS     180
SACP    181
OVLP    184
EDRG    185
POVR    186
SECL    191
ORC-RVQ  192
AINS    200
IPRA    202
XPE     203
XCT0    204
XCT1    205
MLWU    206
NACD    207
HSE     208
MLM     209
MAID    210
VAWU    212
EAR     214
ECT     215
BRI     216
IVR     218
MWI     219
MSDL    222
FC68    223
M911    224
CWNT    225
SSAU    229
BRIT    233
FCDR    234
BRIL    235
MCMO    240
MULTI_USER   242
ALRM_FILTER   243
VMBA    246
CALL ID   247
M911 ENH   249
DPNA    250
SCDR    251
ARFW    253
PHTN    254
ADMINSET  256
ATX     258
QSIG    263
NI-2    291
MAT     296
MQA     297
CPP     301
```

PAGE 003

```
QSIGGF   305
CPRKNET   306
PAGENET   307
CPCI   310
NGCC   311
TATO   312
TATO   312
QSIG-SS   316
QTN   321
NGEN   324
RANBRD   327
MUSBRD   328
ESA  329
ESA_SUPP  330
ESA_CLMP  331
CNUMB   332
CNAME   333
NI-2 CBC   334
MEET   348
MC32   350
DBA   351
FDID   362
NMCE   364
STS_MSG   380
CDIR   381
VIRTUAL_OFFICE   382


REQ  ****
>
OVL000
```

Catalyst 2621 Router Configuration

The following shows the configuration of the Cisco 2621 Router.

```
2621_B#show version
Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-JS-M), Version 12.2(3.5)T,  MAINTENANCE INTERIM S
OFTWARE
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Fri 03-Aug-01 22:45 by ccai
Image text-base: 0x80008088, data-base: 0x81631DD8

ROM: System Bootstrap, Version 12.1(3r)T2, RELEASE SOFTWARE (fc1)

2621_B uptime is 1 week, 4 days, 3 hours, 15 minutes
System returned to ROM by power-on
System image file is "flash:c2600-js-mz.122-3.5.T"

cisco 2621 (MPC860) processor (revision 0x200) with 56320K/9216K bytes of memory
.
Processor board ID JAD051516TX (503811939)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
```

```
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.1.
2 FastEthernet/IEEE 802.3 interface(s)
24 Serial network interface(s)
2 Channelized T1/PRI port(s)
32K bytes of non-volatile configuration memory.
16384K bytes of processor board System flash (Read/Write)


Configuration register is 0x2102


2621_B#
_____
2621_B#show diag
Slot 0:
        C2621 2FE Mainboard Port adapter, 2 ports
        Port adapter is analyzed
        Port adapter insertion time unknown
        EEPROM contents at hardware discovery:
        Hardware Revision       : 2.0
        PCB Serial Number       : JAD051516TX (503811939)
        Part Number             : 73-3200-08
        RMA History             : 00
        RMA Number              : 0-0-0-0
        Board Revision          : A0
        Deviation Number        : 0-21249
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 00 A2 41 02 00 C1 17 4A 41 44 30 35 31
          0x10: 35 31 36 54 58 20 28 35 30 33 38 31 31 39 33 39
          0x20: 29 82 49 0C 80 08 04 00 81 00 00 00 00 42 41 30
          0x30: 80 00 00 53 01 FF FF FF FF FF FF FF FF FF FF FF
          0x40: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x50: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

Slot 1:
        High Density Voice Port adapter
        Port adapter is analyzed
        Port adapter insertion time unknown
        EEPROM contents at hardware discovery:
        Hardware Revision       : 1.1
        Top Assy. Part Number   : 800-03567-01
        Board Revision          : F1
        Deviation Number        : 0-0
        Fab Version             : 02
        PCB Serial Number       : JAB05080LU9
        RMA Test History        : 00
        RMA Number              : 0-0-0-0
        RMA History             : 00
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 00 CC 41 01 01 C0 46 03 20 00 0D EF 01
          0x10: 42 46 31 80 00 00 00 00 02 02 C1 8B 4A 41 42 30
          0x20: 35 30 38 30 4C 55 39 03 00 81 00 00 00 00 04 00
          0x30: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x40: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

```
         0x50: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
         0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
         0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

     VIC Slot 0:
     T1 (2 Port) Multi-Flex Trunk (Drop&Insert) WAN Daughter Card
     Hardware revision 1.0          Board revision B0
     Serial number      17759676    Part number      800-04614-01
     Test history       0x0         RMA number       00-00-00
     Connector type     PCI
     EEPROM format version 1
     EEPROM contents (hex):
       0x20: 01 24 01 00 01 0E FD BC 50 12 06 01 00 00 00 00
       0x30: 58 00 00 00 00 01 15 00 FF FF FF FF FF FF FF FF

     HDV firmware: Compiled Fri 23-Mar-01 00:20 by miriyala
     HDV memory size 524280 heap free 175065


2621_B#
```

```
2621_B#show controllers t1 1/0
T1 1/0 is up.
  Applique type is Channelized T1
  Cablelength is long gain36 0db
  No alarms detected.
  alarm-trigger is not set
  Version info Firmware: 20010710, FPGA: 15
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  Data in current interval (184 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
2621_B#
```

```
2621_B#show configuration
Using 1824 out of 29688 bytes
!
version 12.2
no parser cache
service timestamps debug datetime msec localtime show-timezone
service timestamps log uptime
no service password-encryption
!
hostname 2621_B
!
no logging buffered
enable password cisco
!
!
!
memory-size iomem 15
voice-card 1
 dspfarm
!
ip subnet-zero
!
```

```
!
no ip domain-lookup
!
isdn switch-type primary-ni
!
!
voice class codec 1
 codec preference 1 g729r8
 codec preference 2 g711ulaw
 codec preference 3 g711alaw
!
!
!
!
!
!
!
controller T1 1/0
 framing esf
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 1/1
 shutdown
 framing esf
 linecode b8zs
!
!
!
!
interface FastEthernet0/0
 ip address 192.168.100.2 255.255.255.0
 no ip mroute-cache
 load-interval 30
 no keepalive
 speed auto
 half-duplex
!
interface FastEthernet0/1
 ip address 10.1.1.129 255.255.255.0
 no ip mroute-cache
 duplex auto
 speed auto
!
interface Serial1/0:23
 no ip address
 no logging event link-status
 isdn switch-type primary-ni
 isdn incoming-voice voice
 isdn T309-enable
 isdn T306 30000
 isdn T310 40000
 no cdp enable
!
router rip
 network 1.0.0.0
 network 192.168.100.0
```

```
!
ip classless
no ip http server
ip pim bidir-enable
!
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
!
snmp-server packetsize 4096
snmp-server manager
tftp-server nvram
call rsvp-sync
!
voice-port 1/0:23
!
!
mgcp profile default
!
dial-peer cor custom
!
!
!
dial-peer voice 1 pots
 destination-pattern 3...
 direct-inward-dial
 port 1/0:23
 prefix 3
!
dial-peer voice 3 voip
 destination-pattern 5...
 progress_ind setup enable 1
 voice-class codec 1
 session target ipv4:10.1.1.2
 dtmf-relay h245-alphanumeric
!
!
line con 0
 exec-timeout 0 0
line aux 0
 exec-timeout 0 0
line vty 0 4
 exec-timeout 0 0
 password cisco
 login
line vty 5 15
 exec-timeout 0 0
 login
!
scheduler allocate 3996 1000
!
end

2621_B#
```

Test Configuration

The following figure represents the various configurations used for testing.

Basic Call Setup End-to-End Configuration
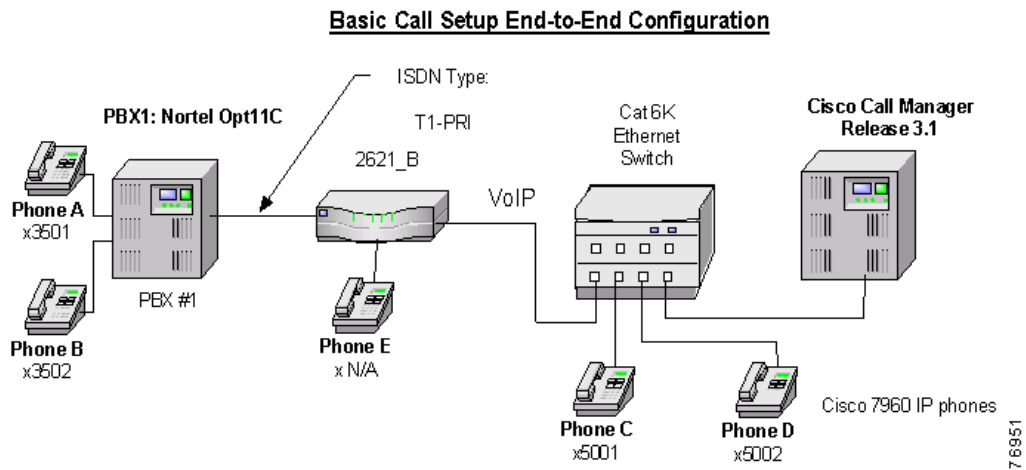
As shown in the figure above,, a Nortel Meridian Opt 11C PBX was connected via an ISDN T1 PRI link to a Cisco 2621, which in turn, was connected to an Ethernet switch. The interoperability testing involved Layers 1, 2 and 3 on the ISDN PRI link between a Cisco 2621 and the PBX.

Layer 1 (Physical Layer)

The Nortel configuration screen for the T1 trunk interface is reached using LD 17, setting the CEQU (Common Equipment parameters).

Layers 2 & 3 (Q.921 and Q.931)

Layer 2 and 3 packet exchanges were monitored using an Acacia Clarinet protocol analyzer, bridged across the PRI link in high impedance mode.

Layer 2 Q.921 packets were monitored to ensure that each PBX/2621 software configuration properly exchanged SABME/UA packets to initialize the ISDN link, and then RR packets were exchanged every 30 seconds.

Layer 3 Q.931 packets were monitored to ensure that the appropriate call setup/teardown packets were exchanged for each configuration, and that the SETUP packets contained the mandatory Information Elements with the necessary details, as well as optional IEs such as Calling Name and Number.

Telephone calls were made end-to-end in both directions through the Cisco 2621 Gateway, and a check was made to ensure that there was an audio path in both directions for each call.

User/Network Settings

The Cisco 2621 Gateway with ISDN protocol type setting of primary-ni supports both protocol sides using the **isdn protocol-emulate network/user** command.

The Nortel Meridian Option 11C, when set to NI2, supports both the USER and NETWORK protocol sides. This USER/ NETWORK choice is set on the Nortel by using LD 17.

Test Results

Testing was performed by Test Engineer(s): Samir Batio, September 10, 2001

Test 1

In test 1:

- The PBX1 country-protocol is set to NI2 to emulate the Network.
- The Cisco 6608-T1 Gateway was configured as a primary-ni to emulate the User.

The results are shown in the following tables.

Table 1 Basic Calls (Enbloc Sending)

Calls Made	Call Comp?	Calling Number passed to final destination?	Calling Name passed to final destination?	Called Number passed to original side?	Called Name passed to the original side?
Phone A to Phone C	Yes	Yes	No[1]	No [2]	No
Phone C to Phone A	Yes	Yes	No	Yes	No

1. The Nortel PRI interface with NI2 setting does not support "Calling Name" presentation Feature.
2. CallManager is not sending the Connected Number information in the CONNECT message back to PBX.

Table 2 Call Transfers (Supervised Local Transfers)

Calls Made	Call Comp?	Original Calling Number displayed on final dest phone?	Original Calling Name displayed on final dest phone?	Called Number display on original phone updated after transfer?	Called Name display on original phone updated after transfer?
Phone C to Phone A Xfr to Phone B	Yes	Yes	No	No	No
Phone A to Phone C Xfr to Phone D	Yes	Yes	No	No	No

Table 3 Call Conferencing (Local)

Calls Made	Call Comp?	Calling Number passed to the remaining conferee when the conferencing phone drops out?	Calling Name passed to the remaining conferee when the conferencing phone drops out?	Connected Number updated on original caller phone display when a conferee drops out?	Connected Name updated on original caller phone display when a conferee drops out?
Phone C to Phone A, Phone A conf Phone B	Yes	(A Drops out) Yes	(A Drops out) No	(A Drops out) No	(A Drops out) No
Phone C to Phone A, Phone C conf Phone D	Yes	(C Drops out) No	(C Drops out) No	(D Drops out) No	(D Drops out)
Phone A to Phone C, Phone C conf Phone D	Yes	(C Drops out) No	(C Drops out) No	(C Drops out) No	(C Drops out) No
Phone A to Phone C, Phone A conf Phone B	Yes	(A Drops out) No	(A Drops out) No	(B Drops out) No	(B Drops out) No

Table 4 Call Forward (Local)

Calls Made	Call Comp?	Original Calling Number passed to final dest?	Original Calling Name passed to final dest?	Forwarding Called Number passed to final dest?	Forwarding Called Name passed to final dest	Final destination Connected Number updated at original side?	Final destination Connected Name updated at original side?
Phone C to Phone A fwd to Phone B	Yes	Yes	No	Yes	Yes	No	No
Phone A to Phone C fwd to Phone D	Yes	Yes	No	No	No	No	No

Test 2

In test 2:

- The PBX1 country-protocol is set to NI2 to emulate the User.
- The Cisco 2621 Gateway is configured as a primary-ni to emulate the Network.

The test results are identical to those in Test 1.