Application Note

NEC 2400 ICS Rel J 5.8 PBX with CallManager using 2621XM-E1 PRI as MGCP Gateway

This application note illustrates connectivity for NEC 2400 ICS Rel J 5.8 PBX with CallManager using 2621XM-E1 PRI as MGCP Gateway.

Introduction

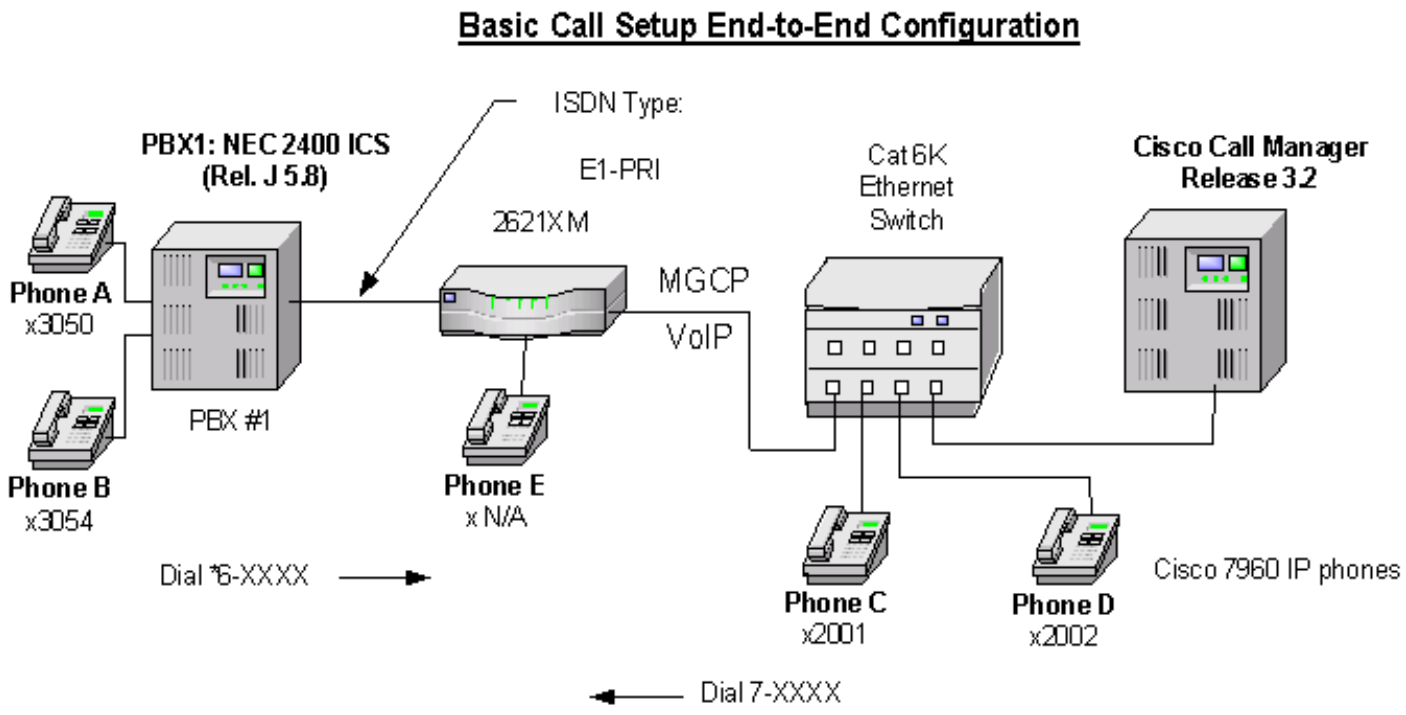
The network topology diagram presented in Figure 1 illustrates the test set-up for end-to-end interoperability with the Cisco CallManager connected to the PBX via 2621XM-E1 PRI link as MGCP Gateway.

Key test environment parameters:

- Connectivity is achieved by using the PRI EURO protocol type on the MGCP gateway and NEC/ETSI switch type on the NEC 2400 PBX. Though the NEC 2400 can be configured as either NETWORK (Master) or USER (Slave) side, this is not recommended and the NEC TAC center will not resolve a case presented with NEC set as NETWORK side.
- Calling Name delivery and presentation features are not supported by the NEC 2400 PBX.
- CCM does not send “Connected Number” information in the CONNECT message back to PBX.

Network Diagram

Figure 1
Network Test Topology



Limitations

Calling Name and Number Feature

Calling Name delivery and presentation feature are not supported by the NEC 2400 ICS PBX.

When calling from Cisco 7960 IP phone to NEC digital phone, both phones display the Number after the call is answered as expected.

When calling from NEC digital phone to Cisco 7960 IP phone, the Cisco IP phone displays Calling Number when the call is answered. NEC phone however does NOT get updated when the call is answered. It displays the numbers being dialed instead (i.e. Access Code + extension number). It was verified using an ISDN protocol analyzer that the CCM was not sending “Connected Number” information in the CONNECT message back to PBX.

System Components

Hardware Requirements

Cisco Hardware:

- Cisco 2621XM with 2MFT-E1 port
- Cisco Cat6K switch

- Cisco CM 3.2

NEC 2400 ICS PBX:

- Hardware: PA-30PRTB

Software Requirements

- PBX Software Release J 5.8.
- Cisco CM 3.2

Feature

Key features supported:

- Calling/Called Number Identification

Key features not supported:

- Updating Connected Number
- Calling/Called Name

Configuration

Sequence of configuration tasks:

1. NEC 2400 ICS Configuration
2. Route (ARTD) Configuration
3. Cisco CallManager Configuration
4. ISDN PRI Configuration

NEC 2400 ICS Configuration

The NEC requires a substantial amount of programming and circuit card switch settings to properly install E1 PRI. It is beyond the scope of this document to provide the entire configuration, therefore the NEC information below is mostly helpful for NEC techs. If further assistance is required, the entire configuration of our lab PBX can be found in EDCS document # EDCS-207455. The EDCS document provides the programs required for E1 ISDN circuit setup, all the switch settings for all cards on our Lab NEC and fairly complete configuration listings (*List Ups*).

Note: The switch settings and software references in the EDCS document assume a familiarity with the NEC 2400. It is highly recommended to have a NEC ISDN certified technician setup the NEC portion.

Configure in the following sequence:

1. Install circuit card.
2. Configure all software.

Table 1 Circuit Card Configuration (PA-30PRTB)t

Switch	Position	Description	Setting
SW00		Make Busy	Down
SW01	0	All Channel Make Busy	Off

Table 1 Circuit Card Configuration (PA-30PRTB)t

Switch	Position	Description	Setting
	1	External Loop Back	Off
	2	Internal Loop Back	Off
	3	Dch Handler Make Busy	Off
SW02 (SENSE - Rotary)		1 = AT&T 2 = Australia 3 = NTT Japan 4 = NEC/ETSI 5 = AT&T 6 = INS A = Q.SIG	4
SW10	Jumper	Off = Coax On = Twisted Pair	On
SW11	Jumper	Off = Coax On = Twisted Pair	On
SW12	Jumper	Off = Coax On = Twisted Pair	On
SW13	1	On = PAD ROM Special Version Off = PAD ROM Standard Version	Off
	2	On = ISDN BUS Not Used Off = ISDN BUS Used	On
	3	Not Used	Off
	4	Not Used	Off
SW14	1	On = CCITT Signaling Off =CEPT Signaling	On
	2	On = Alarm Release: 2sec (Aus) Off = Alarm Release 15 Sec.	On
	3	PAD	On
	4	PAD	On
	5	PAD	On
	6	PAD	On
	7	PAD	On
	8	Fixed Off	Off
SW15	1	Loopback Pattern Off = Loopback inhibited	Off

Table 1 Circuit Card Configuration (PA-30PRTB)t

Switch	Position	Description	Setting
	2	Loopback Pattern Off = Loopback inhibited	Off
	3	Loopback Pattern Off = Loopback inhibited	Off
	4	Loopback Pattern Off = Loopback inhibited	Off
	5	TS16 Control: On = Data Through (CCIS/ ISDN) Off = Signaling	On
	6	On = No CRC4 Off = CRC4	Off
	7	Firmware (CCITT/China/ Thailand/Aux)	On
	8	Firmware (CCITT/China/ Thailand/Aux)	On
SW16	1	Fixed Off	Off
	2	Fixed Off	Off
	3	All “1” Supervision On = To be controlled Off = Not to be controlled	Off
	4	On = Dch User Side Off = Dch Network Side	On
	5	On = Dch NegativeLogic Off = Dch Positive Logic	Off
	6	On = Dch Packet Service On Off = Dch Packet Service Off	Off
	7	Fixed Off	Off
	8	Fixed Off	Off

Route (ARTD) Configuration

Below are the Route settings found in ARTD. Route 12 is the B channel and Route 13 is the D channel. Please refer to EDCS document # EDCS-207455 for complete details for configuration.

```
   [LRTD]                CISCO TEST FACILITY      02/05/10         PAGE:  5

            *  ROUTE CLASS DATA LIST  *

                  -------  R O U T E     N U M B E R  -------
 CDN FUNCTION      11         12         13         14         15

   1  OSGS          7          0          0          0          0
   2  ONSG          3          2          0          2          2
   3  ISGS          7          0          0          0          0
   4  INSG          3          2          0          2          2
   5   TF           3          3          3          3          3

   6   TCL          4          4          4          4          4
   7   L/T          1          1          1          1          1
   8   RLP          2          2          0          2          0
   9   TQ           0          0          0          0          0
  10  SMDR          0          1          1          1          1

  11   TD           0          0          0          0          0
  12   DR           0          0          0          0          0
  13   AC           1          1          0          1          0
  14   TNT          0          0          0          0          0
  15   LSG          5         12         13         12         13

  16 SMDR2          0          0          0          0          0
  17   H/M          0          0          0          0          0
  18   MC           0          0          0          0          0
  19   ANI          0          1          1          1          0
  20   D            0          0          0          0          0

  21   MSB          0          0          0          0          0
  22   MSW          0          0          0          0          0
  23   TR           0          0          0          0          0
  24   OC           0          0          0          0          0
  25   R/L          0          0          0          0          0

  26  RVSD          0          0          0          0          0
  27   TL           0          0          0          0          0
  28   ANS          0          1          1          1          1
  29  TELP          0          0          0          0          0
  30   PAD          0          4          7          4          7

  31  OGRL          0          1          1          1          1
  32  ICRL          0          1          1          1          1
  33   HD           0          0          0          0          0
  34 GUARD          0          1          1          1          1
  35  WINK          0          0          0          0          0

  36   VAD          0          0          0          0          0
  37   CLD          0          0          0          0          0
```

38	FA	0	0	0	0	0

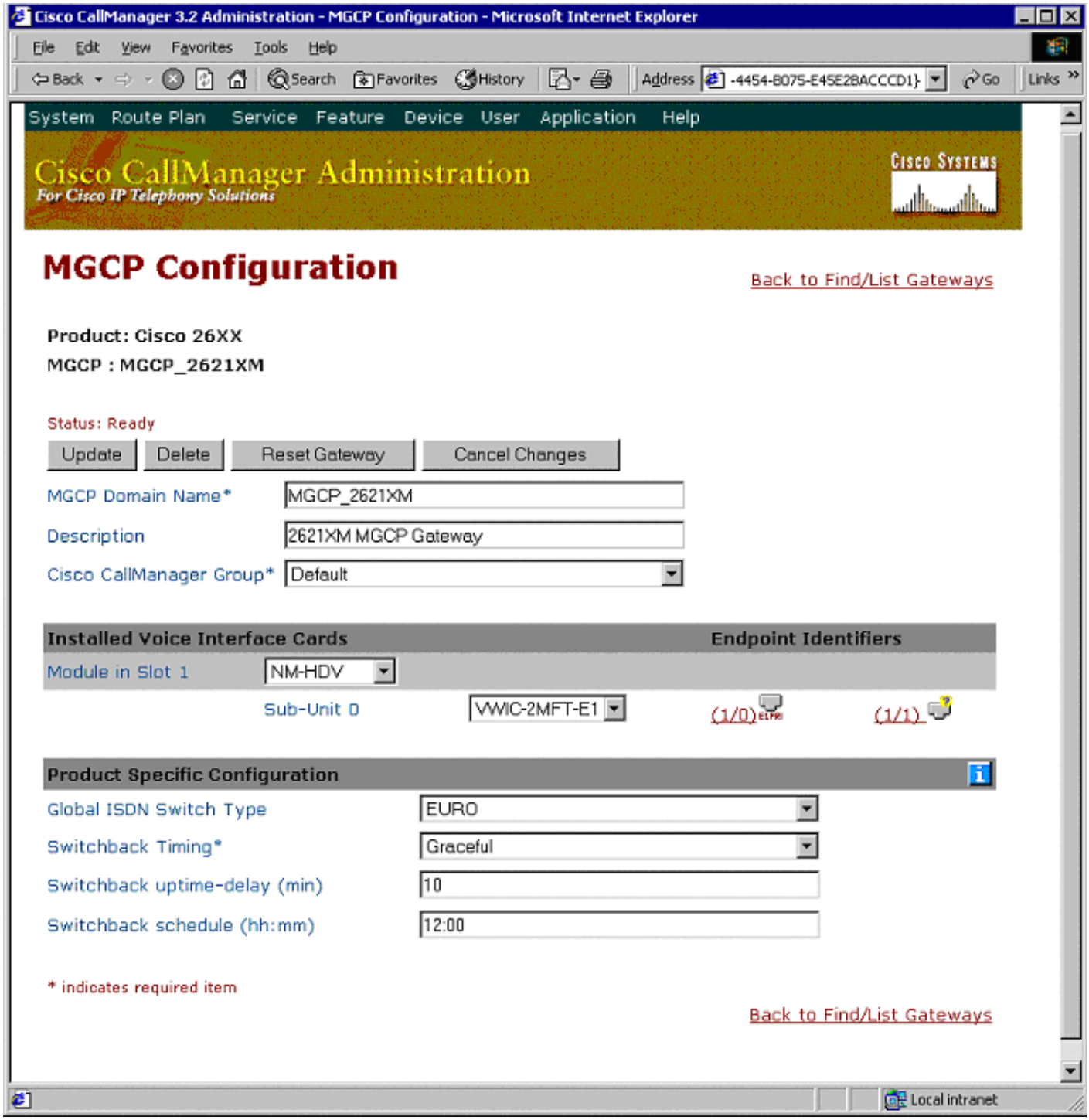
[LRTD] CISCO TEST FACILITY 02/05/10 PAGE: 6

* ROUTE CLASS DATA LIST *

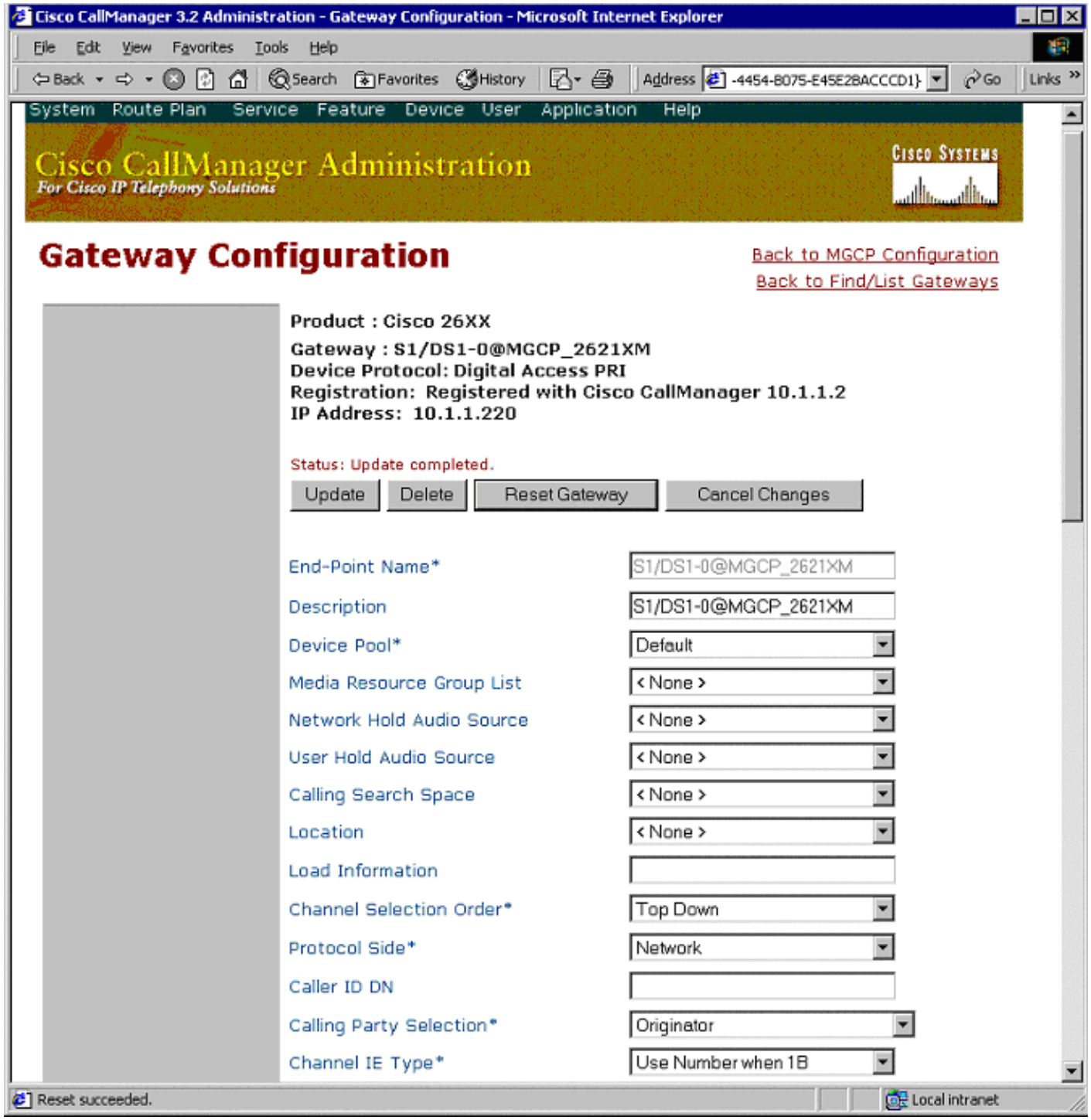
		ROUTE NUMBER				
CDN	FUNCTION	11	12	13	14	15
39	BC	0	0	0	0	0
40	TCM	0	0	0	0	0
41	TDMQ	0	0	0	0	0
42	TRSC	0	0	0	0	0
43	BT	0	1	0	1	1
44	PRV	0	0	0	0	0
45	A/D	0	1	1	1	1
46	CW	0	0	0	0	0
47	TPQ	0	0	0	0	0
48	BL	0	0	0	0	0
49	TRKS	0	1	1	0	0
50	DPLY	0	1	1	1	1
51	ACD	0	0	0	0	0
52	2W/4W	1	0	0	0	0
53	FAAT	0	0	0	0	0
54	GW	0	0	0	0	0
55	TCMA	0	0	0	0	0
56	SMDR3	0	0	0	0	0
57	HDT	0	0	0	0	0
58	CD	0	0	0	0	0
59	CCH	0	0	0	0	0
60	TC/EC	0	0	0	0	0
61	IRE	0	0	0	0	0
62	SCR	0	0	0	0	0
63	LYER1	0	1	1	1	1
64	NET	0	1	0	0	0
65	INT	0	4	4	4	4
66	DC	0	4	4	4	4
67	HKS	0	0	0	0	0
68	SCF	0	0	0	0	0
69	SMDR4	0	0	0	0	0

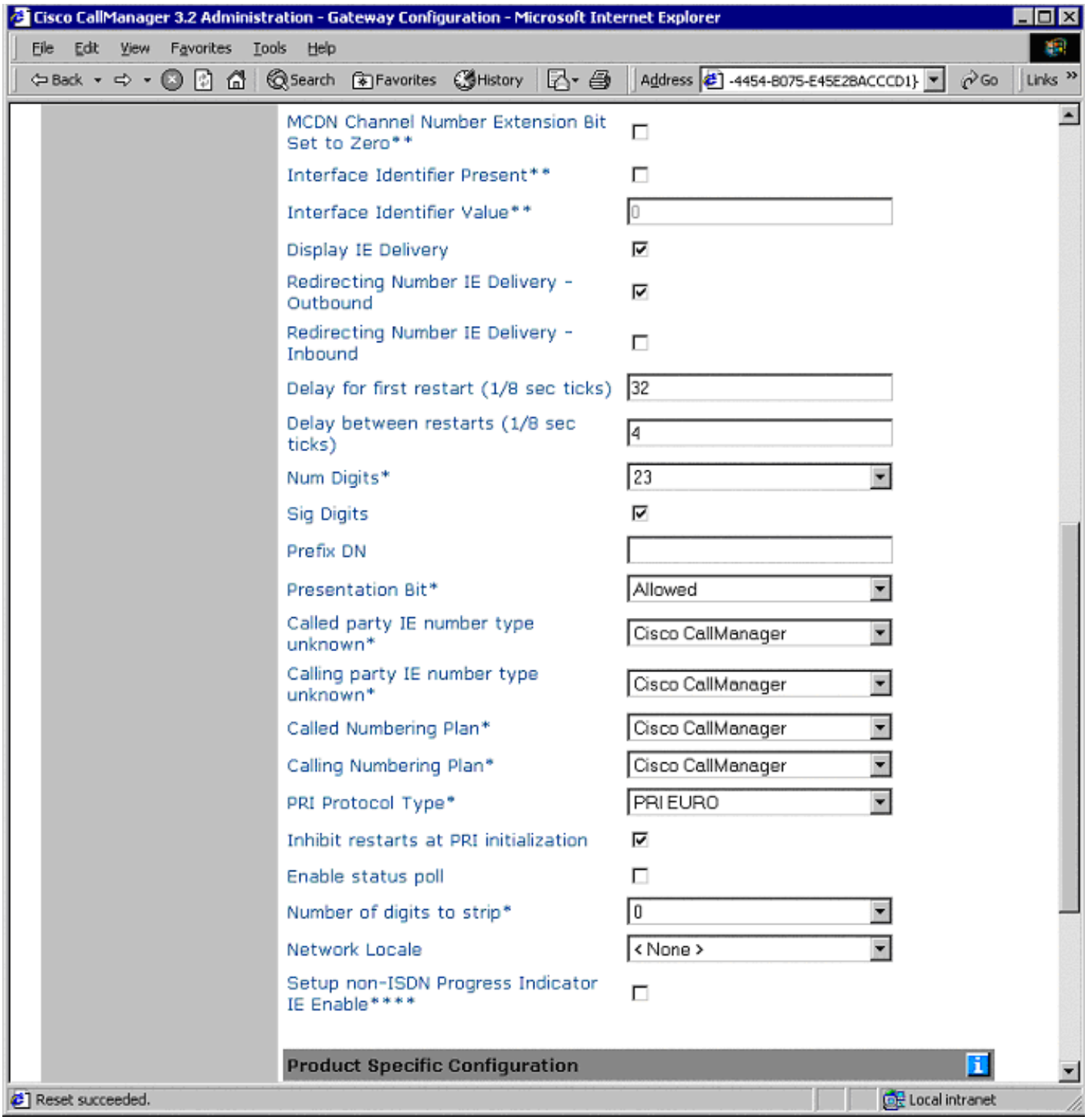
Cisco CallManager Configuration

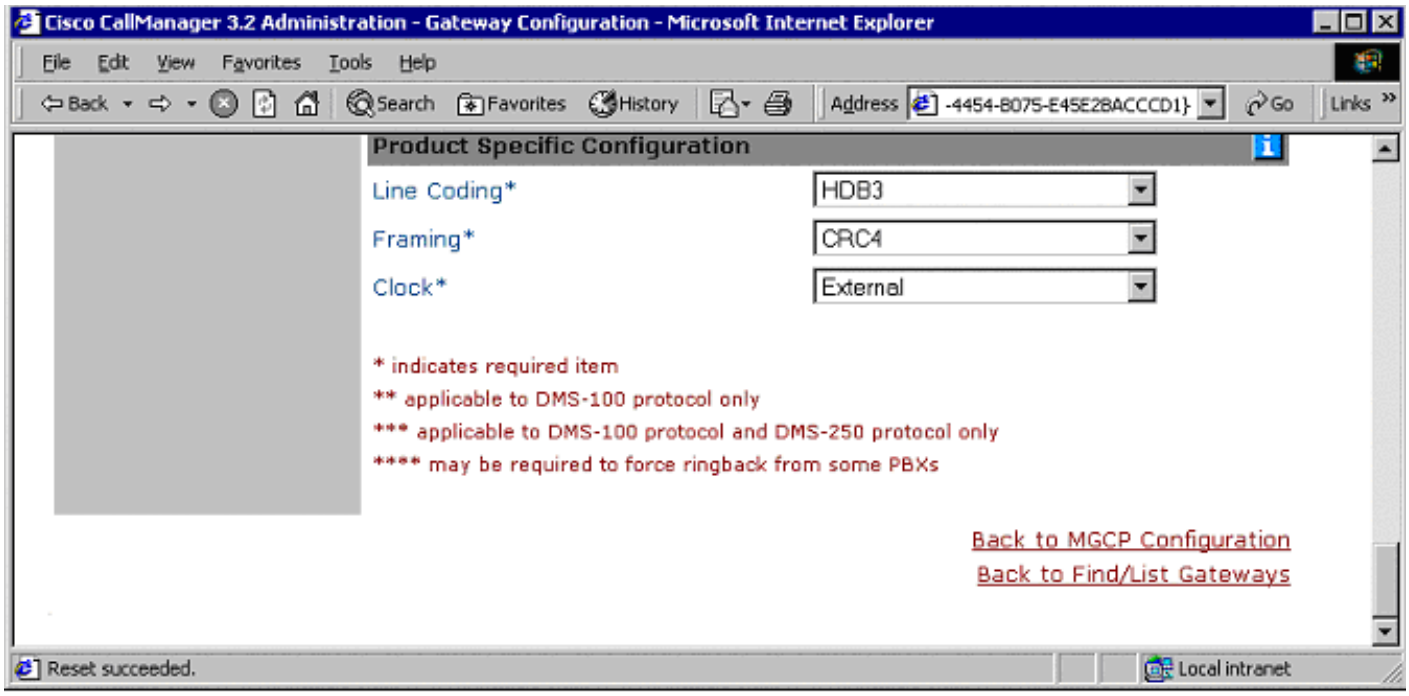
MGCP 2621XM-E1 Gateway Configuration



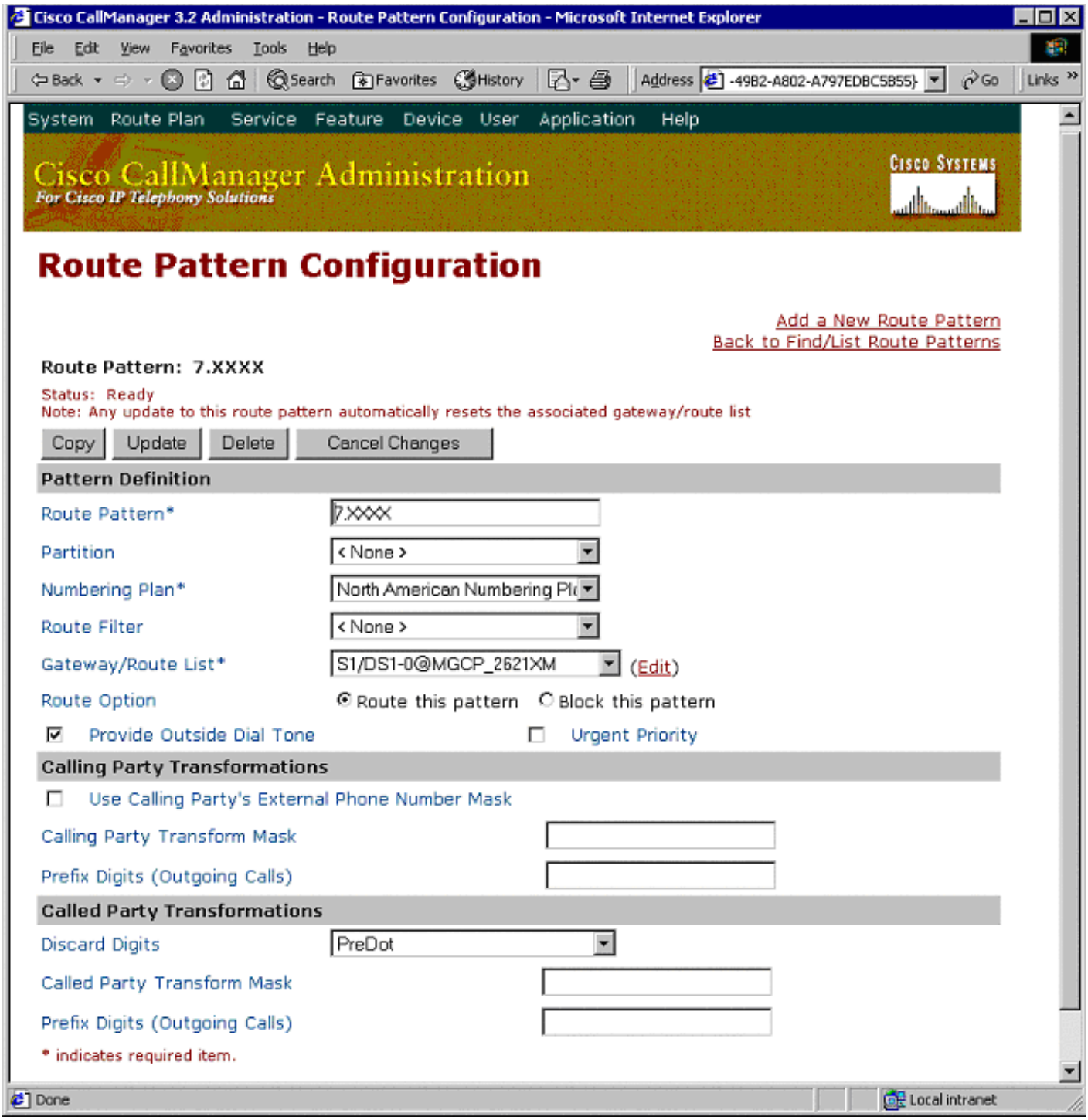
ISDN PRI Configuration





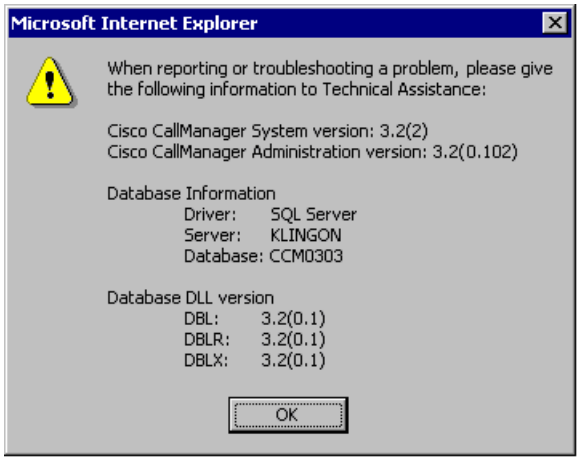


Route Pattern Configuration



Appendix A

Cisco CallManager Software Release



NEC 2400 ICS Software Release

Software Release:

```
VERSION   ISSUE      DATE
  J       05.80    00/06/20  Generic
  F       01.00    96/04/26  Boot ROM
```

Cisco 2621XM Gateway Configuration

```
MGCP_2621XM#sh version
Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-JS-M), Version 12.2(10.7)T2,  MAINTENANCE INTERIM
 SOFTWARE
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Wed 05-Jun-02 12:20 by ccai
Image text-base: 0x8000809C, data-base: 0x819781E4

ROM: System Bootstrap, Version 12.2(7r) [cmong 7r], RELEASE SOFTWARE (fc1)

MGCP_2621XM uptime is 1 hour, 1 minute
System returned to ROM by reload
System image file is "flash:c2600-js-mz.122-10.7.T2"

cisco 2621XM (MPC860P) processor (revision 0x100) with 124928K/6144K bytes of me
mory.
Processor board ID JAD06110FE9 (4191950531)
M860 processor: part number 5, mask 2
Channelized E1, Version 1.0.
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)
31 Serial network interface(s)
2 Channelized E1/PRI port(s)
32K bytes of non-volatile configuration memory.
49152K bytes of processor board System flash (Read/Write)

Configuration register is 0x2102

MGCP_2621XM#
MGCP_2621XM#sh diag
Slot 0:
        C2621XM 2FE Mainboard Port adapter, 2 ports
        Port adapter is analyzed
        Port adapter insertion time unknown
        EEPROM contents at hardware discovery:
        Hardware Revision        : 1.0
        PCB Serial Number        : JAD06110FE9 (4191950531)
        Part Number              : 73-7754-02
        RMA History              : 00
        RMA Number               : 0-0-0-0
        Board Revision           : A0
        Deviation Number         : 0-0
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 03 6D 41 01 00 C1 18 4A 41 44 30 36 31
          0x10: 31 30 46 45 39 20 28 34 31 39 31 39 35 30 35 33
          0x20: 31 29 82 49 1E 4A 02 04 00 81 00 00 00 00 42 41
          0x30: 30 80 00 00 00 00 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
```

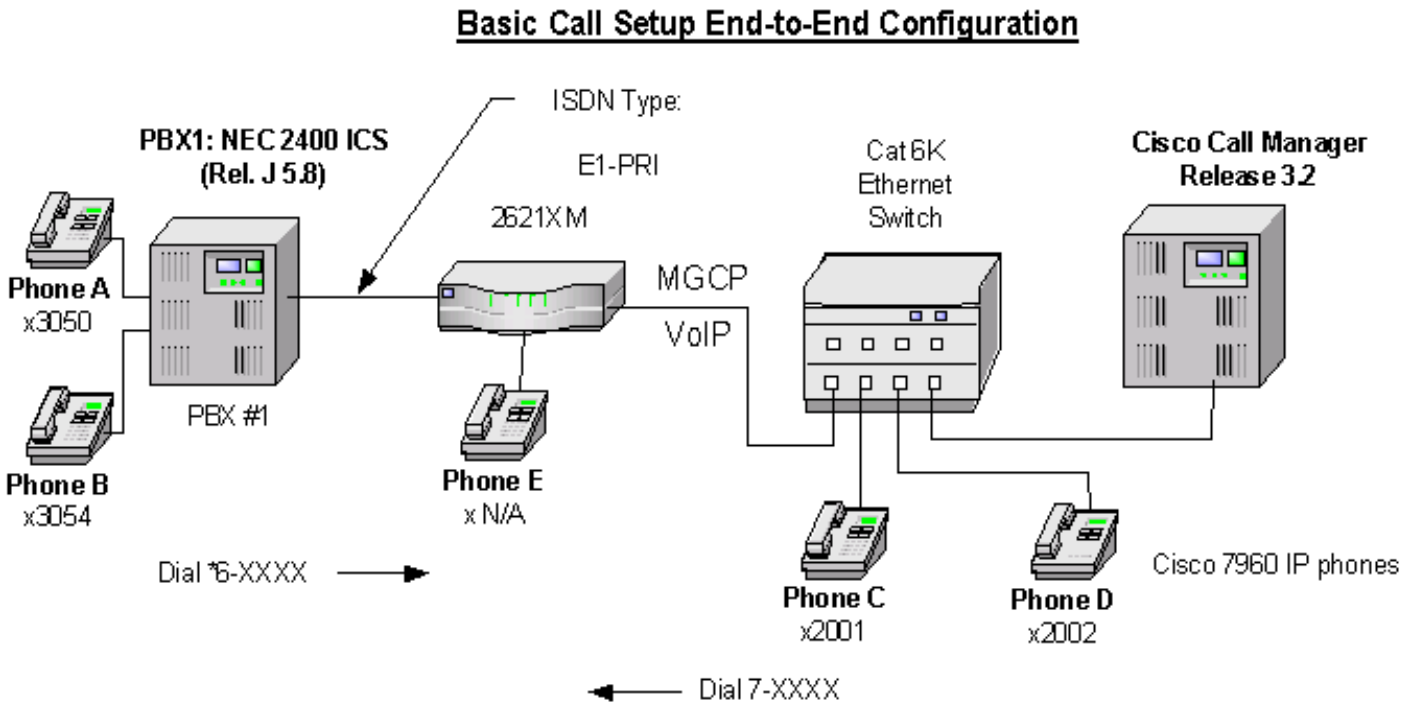
```
          0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

Slot 1:
        High Density Voice Port adapter
        Port adapter is analyzed
        Port adapter insertion time unknown
        EEPROM contents at hardware discovery:
        Hardware Revision        : 1.0
        Top Assy. Part Number    : 800-03567-01
        Board Revision           : A0
        Deviation Number         : 0-0
        Fab Version              : 02
        PCB Serial Number        : JAB033906YA
        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 00 C0 46 03 20 00 0D EF 01
          0x10: 42 41 30 80 00 00 00 00 02 02 C1 8B 4A 41 42 30
          0x20: 33 33 39 30 36 59 41 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:
        E1 (2 Port) Multi-Flex Trunk WAN Daughter Card
        Hardware revision 1.0           Board revision B0
        Serial number     25028793      Part number    800-04479-02
        Test history      0x0           RMA number     00-00-00
        Connector type    PCI
        EEPROM format version 1
        EEPROM contents (hex):
          0x20: 01 23 01 00 01 7D E8 B9 50 11 7F 02 00 00 00 00
          0x30: 58 00 00 00 01 02 16 00 FF FF FF FF FF FF FF FF

        HDV firmware: Compiled Thu 27-Dec-01 13:17 by miriyala
        HDV memory size 524280 heap free 171117


MGCP_2621XM#


MGCP_2621XM#sh controllers e1 1/0
E1 1/0 is up.
  Applique type is Channelized E1 - balanced
  No alarms detected.
  alarm-trigger is not set
  Version info Firmware: 20020306, FPGA: 11
  Framing is CRC4, Line Code is HDB3, Clock Source is Line.
  Data in current interval (56 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
```

```
MGCP_2621XM#
MGCP_2621XM#sh run
Building configuration...

Current configuration : 1381 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname MGCP_2621XM
!
!
voice-card 1
!
ip subnet-zero
!
!
!
isdn switch-type primary-net5
!
!
voice call carrier capacity active
!
!
!
!
!
!
!
!
!
ccm-manager mgcp
ccm-manager music-on-hold
ccm-manager config server 10.1.1.2
ccm-manager config
fax interface-type fax-mail
mta receive maximum-recipients 0
!
controller E1 1/0
 pri-group timeslots 1-31 service mgcp
!
controller E1 1/1
!
!
!
!
interface FastEthernet0/0
 ip address 10.1.1.220 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
```

```
 speed auto
!
interface Serial1/0:15
 no ip address
 no logging event link-status
 isdn switch-type primary-net5
 isdn protocol-emulate network
 isdn incoming-voice voice
 isdn bind-l3 ccm-manager
 no cdp enable
!
ip classless
no ip http server
ip pim bidir-enable
!
!
!
!
call rsvp-sync
!
voice-port 1/0:15
!
mgcp
mgcp call-agent 10.1.1.2 service-type mgcp version 0.1
mgcp dtmf-relay voip codec all mode out-of-band
mgcp modem passthrough voip mode nse
mgcp package-capability rtp-package
no mgcp timer receive-rtcp
mgcp sdp simple
!
mgcp profile default
!
dial-peer cor custom
!
!
!
dial-peer voice 1015 pots
 application mgcpapp
 port 1/0:15
!
!
line con 0
line aux 0
line vty 0 4
 login
line vty 5 15
 login
!
!
end

MGCP_2621XM#
```

Test Configuration

Figure 2
Test Topology



As shown in the diagram above, an NEC 2400 ICS PBX was connected via an ISDN E1 PRI link to a Cisco 2621XM-E1 Gateway, 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 2621XM-E1 and the PBX.

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/2621XM-E1 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 2621XM-E1 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 2621XM-E1 Gateway with ISDN protocol type setting of PRI EURO supports both protocol sides by selecting "Network/User" in the Protocol Side field when configuring the Gateway via CCM. The NEC 2400 ICS PBX supports "USER" protocol side.

Appendix B

Test Results

Testing was performed by Test Engineer(s): Samir Batio, June 12, 2002

Test Setup

Test configuration:

- PBX1 configured as ETSI, emulates User
- Cisco 2621XM-E1 Gateway configured as PRI EURO, emulates Network

Table 2 Test Setup Switch and Gateway Settings

NEC 2400 ICS Switch-type / Protocol-side Setting	Cisco 2621XM-E1 ISDN Protocol-type/ Protocol-side Setting
ETSI / User	PRI EURO / Network

Table 3 Basic Calls: (Enbloc Sending)

Calls Made	Call Comp?	"Calling Number" Passed to Final Destination?	"Calling Name" Passed to Final Destination?	"Called Number" Passed to Orig. Side?	"Called Name" Passed to Orig. Side?	Notes
Phone A to Phone C	Yes	Yes	No	No[1]	No	[2]
Phone C to Phone A	Yes	Yes	No	Yes	No	

1. CCM does not support sending "Connected Number" information in the connect message back to PBX.
2. The NEC 2400 with switch-type setting of ETSI for the PRI interface does not support "Calling Name" presentation feature.

Table 4 Basic Calls: (FXS Port)

Calls Made	Call Comp?	"Number" Displayed on the digital phone?	"Name" Displayed on the digital phone?	Notes
Phone E to Phone A	**N/A**			
Phone A to Phone E	**N/A**			
Phone E to Phone C	**N/A**			
Phone C to Phone E	**N/A**			

Table 5 Basic Calls with Overlap Sending/Receiving: (check trace to verify Overlap mode)

Calls Made	Call Comp?	"Calling Number" Passed to Final Destination?	"Calling Name" Passed to Final Destination?	"Called Number" Passed to Orig. Side?	"Called Name" Passed to Orig. Side?	Notes
Phone A to Phone C	**N/A**					[1]
Phone C to Phone A	**N/A**					

1. NEC 2400 ICS PBX does not support Overlap sending/Receiving mode.

Table 6 Call Transfers: (Supervised Local Transfers)

Calls Made	Call Comp?	Orig. "Calling Number" displayed on Final Dest. phone?	Orig. "Calling Name" displayed on Final Dest. phone?	"Called Number" display on Orig. phone updated after transfer?	"Called Name" display on Orig. phone updated after transfer?	Notes
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 7 Call Conferencing (Local)

Calls Made	Call Comp?	"Calling Number" passed to remaining conferee when the conferencing phone drops out?	"Calling Name" passed to remaining conferee when the conferencing phone drops out?	"Connected Number" updated on Orig. Caller phone display when a conferee drops out?	"Connected Name" updated on Orig. Caller phone display when a conferee drops out?	Notes
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) No	
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 8 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 dest. "Connected Number" updated at orig. side?	Final dest. "Connected Name" updated at orig. side?	Notes
Phone C to Phone A fwd to Phone B	Yes	Yes	No	No	No	No	No	
Phone A to Phone C fwd to Phone D	Yes	Yes	No	No	No	No	No	

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