Cisco **AVVID Solution**

IP Telephony

Interoperability of

Cisco CallManager 3.0 (Cisco DT-24+ Gateway) with Fujitsu F9600ES PBX Using DS1 ISDN PRI

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Summary

This document contains the results of PBX interoperability testing against DS1 ISDN PRI (NI-2 and others) on the Cisco Call Manager 3.0 (1) with a CiscoDT-24+ DS1 card, connected directly to the Fujitsu F9600ES with software release E12V11L22.

Table 1 - Call Functions Over ISDN shows the call functions passed over the ISDN connection.

Table 1 Call Functions Over ISDN

Fujitsu Country/protocol Definition	CCM/DT24+ PRI Protocol Type	Calling Name	Calling Number
1/0, 7 (Master/Slave, National ISDN)	PRI 5E8 Custom PRI 5E8	No See item #2	Yes
1/0 ,6 (Master/Slave, NT DMS-100)	PRI DMS-100	No See item #3	Yes
1/0 ,2 (Master/Slave, AT&T 5ESS)	PRI 5E8 Custom PRI 5E8	No See item #2	Yes
1/1 ,1 (Master/Slave, AT&T 4ESS)	PRI 4ESS	No See item #2	Yes
1/0,0 (Master/Slave, NT DMS-250)	PRI DMS-250	No See item #2	Yes

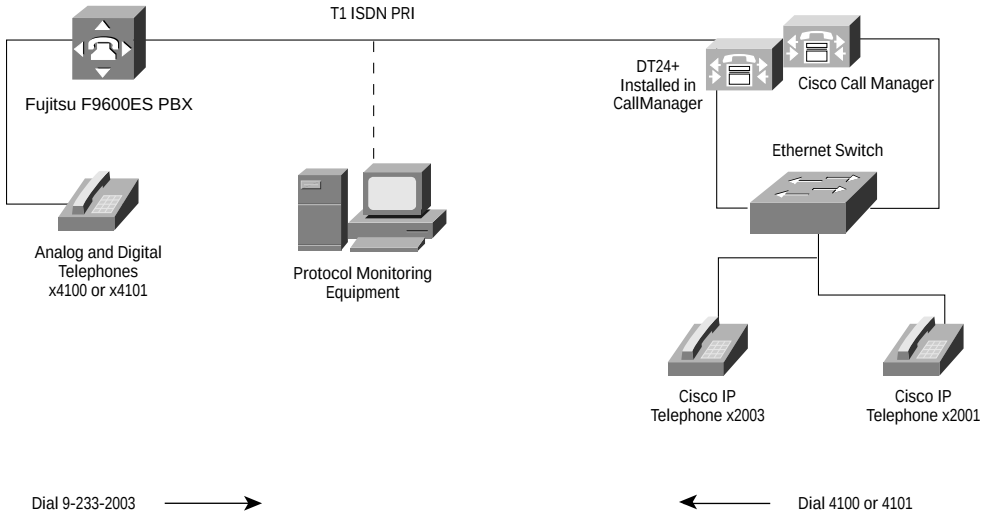
The following points should be noted:

- The Fujitsu F9600ES provided clock on the interface, so the Cisco DT-24+ interface was set to derive its clock from the incoming Fujitsu F9600ES DS1 line to work with it.
- The Fujitsu F9600 PBX and the Cisco Call Manager were both configured to deliver and present calling name information. However, neither the Cisco IP Phone nor the Fujitsu digital station phone displayed name information. The protocol analyzer call trace shows that the Fujitsu sends the calling party's name to the Cisco 3640 router using the ITU-T message format. The name information is in the SETUP message under the Calling Party Subaddress Information Element [IE] (0/6d). On the other hand, the Call Manager sends the name information under the Display IE (0/28), which is an ANSI message format. Refer to Section 3, under Calling Name and Number Feature section, for more information on set-up and results.
- The Fujitsu PBX does send the calling name information under IE (0/28) when the protocol is set to DMS-100. This is set by changing the service parameter ID 180 (DMS100 Network Name Display) from "0" to "1". However, calls were not completed when calling from the Fujitsu to the Call Manager. The protocol analyzer did not show the calls being disconnected but the Cisco IP phone re-initializes every time it is being called. Setting the service parameter back to 0 causes the calls to be completed but without calling name displayed.
- There is a noticeable delay when placing a call from the Fujitsu to the Cisco Call Manager via a Cisco DT-24+ or a 3640 router as the gateway. It takes approximately 7 to 8 seconds after dialing before the Cisco IP Phone rings. Please note that when calling from the Cisco IP phone towards the Fujitsu there is NOT a comparable delay in connecting to the phone on the Fujitsu side.
- For ISDN switch-type DMS-250, calls from the Fujitsu PBX to the Call Manager failed when the Call Manager DT-24+ was set to be the "USER" and the Fujitsu PBX was set to "MASTER" side. The protocol analyzer shows the call being disconnected with a cause code of "Message incompatible/non-existent". However, calls were completed from the Call manager to the Fujitsu PBX.

Test Configuration

Figure 1 - Basic Call Setup Configuration shows the basic call setup configuration.

Figure 1 Basic Call Setup Configuration



As shown in the figure above, the interoperability testing involved Layers 1, 2 and 3 on the DS1 ISDN PRI link between the Cisco Call Manager 3.0 (1) w/ DT24+ and the Fujitsu F9600ES PBX.

Layer 1 (Physical Layer)

The Fujitsu F9600ES PBX was set for Extended Superframe (ESF) and B8ZS linecoding method.

Issue DIS TGDC to display Trunk Group Data Control.

DS1 Clocking

As mentioned above, clocking on the Fujitsu F9600ES PBX was set to provide clocking. To display Main Clock Status, issue the command: DIS MCLKS

DS1 Power Level Settings

The DT-24+ has an integral CSU/DSU and is made to connect directly to an outside DS1 line. Therefore, it uses the FCC Part 68 terminology for transmit power levels, with the settings given as 0dB, -7.5dB, -15dB, and –22.5dB. Note that those settings represent attenuation of the transmit power from the DT-24+ DS1 towards a connected device. Therefore, the 0dB setting is the highest transmit power possible, and the –22.5dB setting is the lowest transmit power for the DT-24+. These values are chosen in the CCM “Gateway Configuration” administrative web page, and the specific field to change is called “TX-Level CSU”.

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 DS1 link in high impedance mode.

Layer 2 Q.921 packets were monitored to ensure that each PBX/CCM 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 Number.

Telephone calls were made in both directions, i.e., from the Fujitsu F9600ES to the CCM through the Cisco 3640 router and visa versa, and a check was made to ensure that there was an audio path in both directions for each call.

User/Network Settings

The protocol type and protocol side cannot be changed in the “Change” or “Modify” ISDN trunk screens on the Fujitsu PBX EMML Console. The protocol type and the Master/Slave (or Network/User) settings had to be changed for every test case by deleting and building a new trunk group on the Fujitsu. The Fujitsu “Master” matches up with the CCM “User”, and Fujitsu “Slave” matches up with CCM “Network”. These settings are specified in the fields [MS] (where “0” = slave and “1” = master); and the [PRTCL] field, where the following choices apply:

Test Results

Table shows the ISDN protocols supported.

Table 2 Supported ISDN Protocols

Fujitsu: Country/protocol Definition	CCM/DT24+: PRI Protocol Type	Results
1/0, 7 (Master/Slave, National ISDN)	PRI 5E8 Custom PRI 5E8	Calls completed in both directions
1/0 ,6 (Master/Slave, NT DMS-100)	PRI DMS-100	With Fujitsu SVP 180 =1; Calls completed only when calling from Call Manager to Fujitsu; With Fujitsu SVP 180 =0; Calls completed in both directions
1/0 ,2 (Master/Slave, AT&T 5ESS)	PRI 5E8 Custom PRI 5E8	Calls completed in both directions
1/1 ,1 (Master/Slave, AT&T 4ESS)	PRI 4ESS	Calls completed in both directions
1/0,0 (Master/Slave, NT DMS-250)	PRI DMS-250	Calls completed only when Fujitsu was set to SLAVE [MS=0] and the Call Manager DT-24+ was set to NETWORK. (See item #5 in Section 1, under “Items worth noting” section)

Calling Number and Name Feature

As shown in the summary, calling name information were not passed between the Fujitsu PBX and the Cisco Call Manager. This may be due to the difference in the systems’ message formats and information element coding. The Fujitsu supports the ITU-T method, where the name information is sent under IE (0/6d). The Cisco Call Manager, on the other hand, supports ANSI message format, which sends the name information under IE (0/28).

The Fujitsu F9600ES PBX supports a “Name over Public Network” feature. This feature provides the capability to send and receive the calling party’s name. This name information is sent by setting up an Automatic Route Selection (ARS) table to access the outgoing ISDN trunk. The system sends the calling party’s name along with the calling party’s number when a call is routed to the ISDN CO trunk, which has been assigned in the ARS table. The system will also transmit the name information to a terminating station (e.g. a digital station phone) if the name is received from an incoming ISDN trunk. Again, this will only work if the far-end PBX uses the same ITU-T message formatting and coding.

Please note that the fact that the Fujitsu is using ITU-T calling name message formatting and coding when set to North American ISDN types means that it is not likely to be compatible ANY North American ISDN PBX.

Also, for ISDN switch-type DMS-100, the Fujitsu does send the calling party’s name information under IE (0/28). This is set by changing the service parameter ID 180 (DMS100 Network Name Display) from “0” to “1”. However, calls were not completed when calling from the Fujitsu to the Call Manager. While the protocol analyzer call trace did not show the calls being disconnected, the Cisco IP phone re-initializes every time it is being called. On the other hand, calls were completed from the Call Manager to the Fujitsu.

The Call Manager IP phone displayed the called number name information from the Notify message sent by the Fujitsu, while the Fujitsu digital phone still did not show the calling name information sent by the Call Manager. Setting the service parameter back to 0 causes the calls to be completed, in both directions, but without the calling name displayed.

As for the Calling Number presentation and delivery, the following parameters must be set:

DID and LDN Calling Line Identification must be added to the database. Feature numbers 335 and 458 must then be added to the COS (Class of Service) accessible features to assure that DID access and Calling Line Identification (CLI) Sending are turned on.

The Service Parameter must also be changed (CHA SVP) so that parameter type 2, ID # 116 (Calling Line Identification Sending to Public ISDN) and 218 (Calling Party Number when connecting from PRI-TIE or PRI-CO to PRI-CO) - are both set to data = "1".

Also, make sure that the list of COS does not include the following feature numbers:
437 - (Calling Number Display Masking)
493 - (ISDN Calling Number Privacy: Access Code for Presentation Allowed)
494 - (ISDN Calling Number Privacy: Access Code for Presentation Restricted)
495 - (ISDN Calling Number Privacy: Presentation Restricted w/o Access Code)

Equipment Configuration

Cisco Call Manager Configuration
Cisco CallManager software release 3.0 (1) was used as shown in Figure 2 - Cisco CallManager Configuration.

Figure 2 Cisco CallManager Configuration

Figure 3 Cisco CallManager Gateway Configuration

Figure 4 Cisco CallManager Route Pattern Configuration

Fujitsu F9600ES PBX Configuration

The following listing provides the commands used to verify Fujitsu F9600ES PBX configuration.

DIS SOFT*To Display PBX Software Version)*

```
                                    00-08-14 MON 12:38
            *** SERVICE SOFTWARE LIST ***
         ALL RIGHTS RESERVED,COPYRIGHT(C)1986 FUJITSU LIMITED
         LICENSED MATERIAL PROGRAM PROPERTY OF FUJITSU
            LPE23924 E12V11L22 C00  000314 INSTALLED
            NAME           TYPE       E/V
            BASCP/D120     360507-D   E12V11
            ATTBS          BASIC--D      V08
            IPRCBS         360561-D      V06
            IBRSBS         360562-D      V01
            IPCH0S         360599-D      V01
            IPREBS         360600-D      V01
            IPEH0S         360601-D      V01
            QSIGBS         360974-D      V02
END 00-08-14 MON 12:38  (CISCO LAB ES R13)
```

DIS ISTRK,,00002000,00002024 *(To Display ISDN Trunk Group)*

```
# ISDN TRUNK ASSIGNMENT LIST #             00-08-14 MON 12:35  PAGE-001
  TNN  TGN        EN  MS PRTCL   QDID   FNA SUBDID   DID   UNA   RSS RSASG
                                 USPID  TID
    0  170  00002000   1     7
    0  171  00002002              -      -      ALL   ALL    -     -      -
    0  171  00002003              -      -      ALL   ALL    -     -      -
    0  171  00002004              -      -      ALL   ALL    -     -      -
    0  171  00002005              -      -      ALL   ALL    -     -      -
    0  171  00002006              -      -      ALL   ALL    -     -      -
    0  171  00002007              -      -      ALL   ALL    -     -      -
    0  171  00002008              -      -      ALL   ALL    -     -      -
    0  171  00002009              -      -      ALL   ALL    -     -      -
    0  171  00002010              -      -      ALL   ALL    -     -      -
    0  171  00002011              -      -      ALL   ALL    -     -      -
    0  171  00002012              -      -      ALL   ALL    -     -      -
    0  171  00002013              -      -      ALL   ALL    -     -      -
    0  171  00002014              -      -      ALL   ALL    -     -      -
    0  171  00002015              -      -      ALL   ALL    -     -      -
    0  171  00002016              -      -      ALL   ALL    -     -      -
    0  171  00002017              -      -      ALL   ALL    -     -      -
    0  171  00002018              -      -      ALL   ALL    -     -      -
    0  171  00002019              -      -      ALL   ALL    -     -      -
    0  171  00002020              -      -      ALL   ALL    -     -      -
    0  171  00002021              -      -      ALL   ALL    -     -      -
    0  171  00002022              -      -      ALL   ALL    -     -      -
    0  171  00002023              -      -      ALL   ALL    -     -      -
    0  171  00002024              -      -      ALL   ALL    -     -      -
 END 00-08-14 MON 12:35  (CISCO LAB ES R13)
```

DIS ISINF,170,171*(To Display Trunk Group Information)*

```
# ISDN TRUNK INFORMATION LIST #            00-08-14 MON 12:35  PAGE-001
  # ONE-INTERFACE #
    < D-CHANNEL >
      TNN TGN       EN MS  PRTCL
        0 170 00002000  1     NI
    < B-CHANNEL >
      TNN TGN       EN  QDID   FNA SUBDID   DID   UNA   RSS RSASG TYP  NSF
        0 171 00002002    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002003    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002004    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002005    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002006    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002007    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002008    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002009    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002010    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002011    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002012    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002013    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002014    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002015    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002016    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002017    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002018    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002019    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002020    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002021    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002022    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002023    -     -     ALL   ALL    -     -       - MUL    0
        0 171 00002024    -     -     ALL   ALL    -     -       - MUL    0
    < CBC GROUP TGN >
      PILOT  MTGN - NSF  MTGN - NSF  MTGN - NSF  MTGN - NSF
      NONE
 END 00-08-14 MON 12:36  (CISCO LAB ES R13)
```

DIS COSF,,1,1(To Display Class of Service Features)

```
# COS CHECK TABLE LIST #                  00-08-14 MON 12:36  PAGE-001
  TNN    COS    --------------AVAILABLE FEATURE NUMBER (FNO)---------------
    0      1     70  71  72  75  76 130 135 138 302 304 318 335 339 348 354
                355 363 365 398 401 404 415 417 422 440 445 458 459 496 498
                540 570 581 591
 END 00-08-14 MON 12:36  (CISCO LAB ES R13)
```

DIS TG,170,171,1*(To Display Trunk Group Information)*

```
# TRUNK GROUP DATA LIST #                  00-08-14 MON 12:37  PAGE-001
  TGN    TYP TID TNN SPC AKI COF TLT DGN RGN COS RSM FRL TRS HNT       NAME
         AKW AKR AKB RGT AOT GRD REL HKS AFT SHK RHK OPR                DMF
         MIN PRE MAK BRK DGT PST PBO PBF COP PGT                        MID
         PAC MBC STG  DT IAS DTS ABS DTK OOC NOC PTF TCS TCR TDT VCM    OGF
         CRC
         NSF NSFFG PRMFF PRMFV CDNFG TON NPI
  170      5  37    0    4    0    0    0   1   1   1   1   1   0   0
           0   0    0    0    0    0    0   0   0   0   0                    0
           0   0    0    0    0    0    0   0   0   0                        0
          28   0    0    0    0    0    0   0   0   0   0   0   0   0   0
           0      0      0      0      0   0   0
  171      5  38    0    5    0    0    0   0   0   1   1   1   0   1
           0   0    0    0    0    0    0   0   0   0   0                    0
           0   0    0    0    0    0    0   0   0   0                        0
          28   0    0    0    0    0    0   0   0   0   0   0   0   0   0
           0      0      0      0      0   0   0
 END 00-08-14 MON 12:37  (CISCO LAB ES R13)
```

DIS NP,,1(To Display Numbering Plan)

```
# NUMBERING PLAN LIST #                   00-08-14 MON 12:41  PAGE-001
  TTID= 1
    DIGIT  EDL  FNO  TGN  TGX  AJC  RDD  DOC  TTN     DN  SVN
   0         1   40                          0
   3        30  591  191              1    1
   40        4   25    0         2           0
   41        4   25    0         2           0
   70       30  540  171              2       0
   71       30  581  181              2       0
   72        6  591  150              2    1
   73       30  581  128              2       0
   74       30  581  129              2       0
   9        30  301    0              1       0
   *11       3   72    0                      0
   *20       7  138    0              3       0
   *21       3  415    0                      0
   *51       3   72    0                      0
   *70       5  398    0         1            0
   *71       5  398    0         1            0
   *72       5  398    0         1            0
   *73       5  398    0         1            0
   *74       5  398    0         1            0
   #67       4  401    0                      0
   D3D       7  138    0              3       0
   D88      30  304    0              3       0
 END 00-08-14 MON 12:41  (CISCO LAB ES R13)
```

DIS MLDT,,4100,4101(To Display Multi-line Digital Telephone Stations)

```
# MLDT ASSIGNMENT LIST #                  00-08-14 MON 12:42  PAGE-001
     DN(   EN   )             TYPE RSM FRL COS OT USG SPDL PD HSC KA
                          BM     LA  PP  RP  IP HF  TT   RB AH PS LT    PDN
                                   NAME AMPT
   4100(00080800)                  3   1   1   1  0   0    2  3  1
                           0       1   1   1   1  1   1    1  1  0  0
                                  'BOB'   0
   4101(00080802)                  3   0   1   1  0   0    2  3  1
                           0       1   1   1   1  1   1    1  1  0  0
                                  'MARY'   0
 END 00-08-14 MON 12:42  (CISCO LAB ES R13)
```

DIS SVP,2,116,116(To Display Service Parameters)

```
# SERVICE LIST #                          00-08-14 MON 12:42  PAGE-001
  TYPE =  2 ( SVSDT )
     ID-----DATA    ID-----DATA    ID-----DATA    ID-----DATA    ID-----DATA
    116        1
 END 00-08-14 MON 12:42  (CISCO LAB ES R13)
```

DIS SVP,2,218,218*(To Display Service Parameters)*

```
# SERVICE LIST #                          00-08-14 MON 12:43  PAGE-001
  TYPE =  2 ( SVSDT )
     ID-----DATA    ID-----DATA    ID-----DATA    ID-----DATA    ID-----DATA
    218        1
 END 00-08-14 MON 12:43  (CISCO LAB ES R13)
```

DIS MCLKS*(To Display Main Clock Source/Status)*

```
# MAIN CLOCK STATUS DISPLAY #             00-08-14 MON 12:45
  < OPERATION STATUS >
     MCLK #0       *
        IN 0
  < ALARM STATUS >
     MCLK #0     NORMAL
        IN 0     TROUBLE
 END 00-08-14 MON 12:45  (CISCO LAB ES R13)
```

DIS ARSC*(To Display ARS Code)*

```
# ARS CODE NUMBER LIST #                  00-08-31 THU 09:56  PAGE-001
  CDNID        DS---ARSTB      DS---ARSTB      DS---ARSTB
   ACDN(1)    2         1     3         1     4         1
              5         1     6         1     7         1
              8         1     9         1
   OCDN(2)    2         2     3         2     4         2
              5         2     6         2     7         2
              8         2     9         2
 END 00-08-31 THU 09:56  (CISCO LAB ES R13)
```

DIS ARSR*(To Display ARS Routes)*

```
# ARS ROUTE TABLE LIST #                  00-08-31 THU 09:57  PAGE-001
   ARSTB   TNN  POS  TGN  FRL  PTNNO  T0 T1 T2 T3 T4 T5 T6 T7  LARF  CMPF
 (NARSTB)              CDNFG    TON NPI  NAMF
       2     0    1  171    0      2   *  *  *  *  *  *  *  *
                           0      0   0     1
      10     0    1    0    0      0   *  *  *  *  *  *  *  *
 END 00-08-31 THU 09:57  (CISCO LAB ES R13)
```

DIS ARSDP*(To Display ARS Dial Plan)*

```
# ARS  RDG  QADP   LIST #                  00-08-31 THU 10:00  PAGE-001
  ARSDG   ARSRG   QADP
      1       0      0
   CICF    OTPF  TOTPF  IOTPF   DFDSLO
      1       1      1      1    3
 END 00-08-31 THU 10:00  (CISCO LAB ES R13)
```

DIS ARSDM*(To Display ARS Digit Manipulation)*

```
# ARS DIGIT MANIPULATION PATTERN LIST #    00-08-31 THU 10:01  PAGE-001
 PTNNO  PRDEL --------PRADG------- PSDEL --------PSADG------- ACPOS ADPN SP
     0      0                         0                         0     0
     1      0                     1   0                         0     0
     2      3                         0                         0     0
     7      0                     7   0                         0     0
    11      3                         0                         0     0
 END 00-08-31 THU 10:01  (CISCO LAB ES R13)
```

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