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Avaya Solution & Interoperability Test Lab

Application Notes for RAD Data Communications Vmux Gateway with Avaya Communication Manager using a T1 interface - Issue 1.0

Abstract

These Application Notes describe a solution for integrating RAD Data Communications Vmux Gateways with Avaya Communication Manager on two different media gateways, Avaya G650 and Avaya G350. RAD Vmux gateways are connected to Avaya gateways through a T1 interface. RAD Vmux is a TDM over IP gateway that enables the TDM T1/E1 circuits to be extended over an IP/Ethernet network.

Information in these Application Notes has been obtained through DevConnect compliance testing and additional technical discussions. Testing was conducted via the DevConnect Program at the Avaya Solution and Interoperability Test Lab.

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1. Introduction

These Application Notes describe a solution for integrating RAD Data Communications Vmux Gateways (Vmux) with Avaya Communication Manager on two different media gateways, Avaya G650 (G650) and Avaya G350 (G350). RAD Vmux gateways are connected to Avaya gateways through a T1 interface. RAD Vmux is a TDM over IP (TDMoIP) gateway that enables the TDM T1/E1 circuits to be extended over an IP/Ethernet network. RAD Vmux deploys TDMoIP technology to extend voice and signaling protocols transparently over packet networks. An Avaya C364T-PWR Converged Stackable Switch and MM314 Power over Ethernet (PoE) HDDM Media Module on Avaya G350 were interconnected to each end of the RAD Vmux gateway to provide the IP packet network.

For additional information on RAD Vmux, refer to [3].

Figure 1 illustrates the network configuration used to verify the RAD Data Communications solution. A T1 interface was used between the Vmux and Avaya gateways. During the test, two RAD Vmux products (Vmux 2100 and Vmux 110) were used.
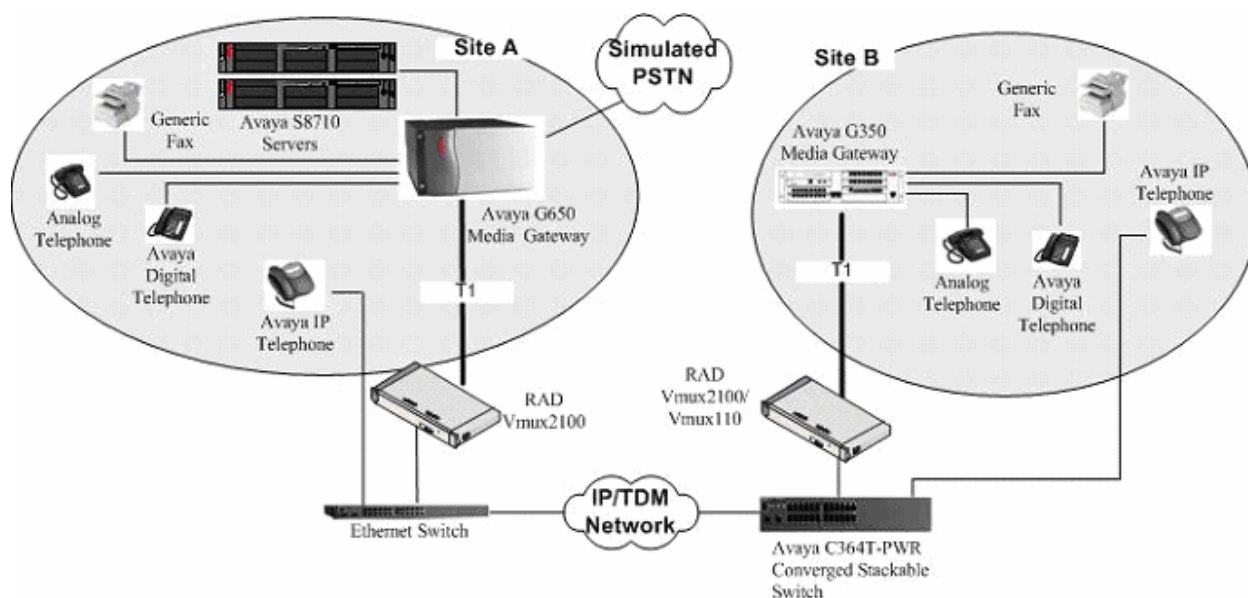

Figure 1 Test configuration of RAD Vmux with Avaya G650 and Avaya G350 Media Gateways (T1 Interface)

2. Equipment and Software Validated

The following equipment and software were used for the sample configuration provided:

Equipment	Software/Firmware
Avaya S8710 Servers	Avaya Communication Manager 5.0 (R015x.00.0.825.4)
Avaya G650 Media Gateway with S8710 Servers	Avaya Communication Manager 5.0 (R015x.00.0.825.4)
TN464GP DS1 Card	HW02 FW 022
TN2312BP IP Server Interface	HW12 FW 40
TN799DP C-LAN Interface	HW01 FW 26
Avaya C364T-PWR Converged Stackable Switch	4.5.14
Avaya 4600 Series SIP Telephones	2.2.2 (4610SW SIP) 2.3 (4602SW H.323) 2.6 (4610SW H.323) 2.5 (4625SW H.323)
Avaya one-X Desktop Edition	2.1 SP2
Avaya 6400 and 8400 Series Digital Telephones	-
Avaya G350 Media Gateway with S8300B Server	Avaya Communication Manager 4.0 (R014x.00.1.731.2)
MM710AP DS1 Card	HW02 FW 018
MM314 PoE HDDM Media Module	HW00 FW 00
RAD Devices	
Vmux 2100	HW 02.00 SW 04.06
Vmux-110	HW 01.00 SW 04.06

3. Configure Avaya Communication Manager

This section describes the necessary configuration on Avaya Communication Manager for T1 operations with Vmux. Configuration steps for configuring Avaya G650 and Avaya G350 are almost identical. Differences in configuration will be pointed out. The configuration of Avaya Communication Manager was performed using the System Access Terminal (SAT). Configuration in the following sections is only for the fields where a value needs to be entered or modified. Default values are used for all other fields. After completion of the configuration in this section, perform a **save translations** command to make the changes permanent. Refer to [1] for additional details.

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3.1. Verifying System Parameters

These steps are common for Avaya G650 and Avaya G350 and are to verify that the proper options are set.

Step	Description
1.	Enter the **display system-parameters customer-options** command and proceed to **Page 3** to verify that **DS1 MSP** field is set to **y**.

	<pre>display system-parameters customer-options Page 3 of 10
	
	        Abbreviated Dialing Enhanced List? n Audible Message Waiting? n
	             Access Security Gateway (ASG)? n Authorization Codes? n
	             Analog Trunk Incoming Call ID? n Backup Cluster Automatic Takeover? n
	   A/D Grp/Sys List Dialing Start at 01? n CAS Branch? n
	  Answer Supervision by Call Classifier? n CAS Main? n
	                                    ARS? y Change COR by FAC? n
	                    ARS/AAR Partitioning? y Computer Telephony Adjunct Links? n
	              ARS/AAR Dialing without FAC? y Cvg Of Calls Redirected Off-net? n
	                  ASAI Link Core Capabilities? n DCS (Basic)? n
	                  ASAI Link Plus Capabilities? n DCS Call Coverage? n
	                Async. Transfer Mode (ATM) PNC? n DCS with Rerouting? n
	          Async. Transfer Mode (ATM) Trunking? n
	                  ATM WAN Spare Processor? n Digital Loss Plan Modification? n
	                                   ATMS? n DS1 MSP? y
	                      Attendant Vectoring? n DS1 Echo Cancellation? y</pre>

2.	Proceed to **Page 5** and verify that **Station and Trunk MSP** field is set to **y**.

	<pre>display system-parameters customer-options Page 5 of 10
	                           OPTIONAL FEATURES
	
	                 Multinational Locations? n Station and Trunk MSP? y
	  Multiple Level Precedence & Preemption? n Station as Virtual Extension? n
	                      Multiple Locations? n
	                                              System Management Data Transfer? n
	           Personal Station Access (PSA)? n Tenant Partitioning? n
	                        Posted Messages? n Terminal Trans. Init. (TTI)? n
	                       PNC Duplication? n Time of Day Routing? n
	                   Port Network Support? y Uniform Dialing Plan? y
	                                              Usage Allocation Enhancements? y
	              Processor and System MSP? n TN2501 VAL Maximum Capacity? y
	                     Private Networking? y
	                     Processor Ethernet? n Wideband Switching? n
	                                                                   Wireless? y
	                          Remote Office? n
	          Restrict Call Forward Off Net? y
	                   Secondary Data Module? y</pre>

3.2. Configuring DS1 for ISDN-PRI Trunks

Following steps are for adding a DS1 card for the ISDN-PRI trunks. **Step 1** is for configuring DS1 card on Avaya G650 and **Step 2** is for configuring DS1 card on Avaya G350.

Step	Description

1.	Enter the **add ds1 1a07** command and configure as follows for Avaya G650:
	• **Name** – Set to any descriptive string.
	• **Line Coding** – Set to **b8zs**.
	• **Framing Mode** – Set to **esf**.
	• **Signaling Mode** – Set to **isdn-pri**.
	• **Connect** – Set to **pbx**.
	• **Interface** – Set to **network**.
	
	<pre>add ds1 1a07 Page 1 of 2
	                            DS1 CIRCUIT PACK
	
	              Location: 01A07 Name: T1 VMUX
	              Bit Rate: 1.544 Line Coding: b8zs
	      Line Compensation: 1 Framing Mode: esf
	        Signaling Mode: isdn-pri
	               Connect: pbx Interface: network
	     TN-C7 Long Timers? n Country Protocol: 1
	  Interworking Message: PROGress Protocol Version: a
	  Interface Companding: mulaw CRC? n
	             Idle Code: 11111111
	                              DCP/Analog Bearer Capability: 3.1kHz
	
	                                      T303 Timer(sec): 4
	
	        Slip Detection? n Near-end CSU Type: other</pre>

Step	Description

2.	Enter the **add ds1 1v5** command and configure as follows for Avaya G350:
	• **Name** – Set to any descriptive string.
	• **Line Coding** – Set to **b8zs**.
	• **Framing Mode** – Set to **esf**.
	• **Signaling Mode** – Set to **isdn-pri**.
	• **Connect** – Set to **pbx**
	• **Interface** – Set to **user**.
	
	<pre>add ds1 1v5 Page 1 of 2
	                          DS1 CIRCUIT PACK
	
	             Location: 001V5 Name: T1 VMUX
	             Bit Rate: 1.544 Line Coding: b8zs
	     Line Compensation: 1 Framing Mode: esf
	        Signaling Mode: isdn-pri
	               Connect: pbx Interface: user
	    TN-C7 Long Timers? n Country Protocol: 1
	  Interworking Message: PROGress Protocol Version: a
	  Interface Companding: mulaw CRC? n
	             Idle Code: 11111111
	                              DCP/Analog Bearer Capability: 3.1kHz
	
	                                   T303 Timer(sec): 4
	
	        Slip Detection? n Near-end CSU Type: other</pre>

3.3. Configuring ISDN-PRI Trunks

To configure the trunks, a trunk group is added and then a signaling group for that trunk group is added. The trunk group is then modified to add the members of the trunk group.

Step	Description
1.	Enter the **add trunk-group** <**t**>, where **t** is an available trunk group and configure as follows: • **Group Type** – Set to **isdn**. • **Group Name** – Set to any descriptive string. • **TAC** – Enter any value per the dial plan. Set to **141** for this compliance testing. • **Service Type** – Set to **tie**. ``` add trunk-group 41 Page 1 of 21 TRUNK GROUP Group Number: 41 Group Type: isdn CDR Reports: y Group Name: T1 PRI COR: 1 TN: 1 TAC: 141 Direction: two-way Outgoing Display? n Carrier Medium: PRI/BRI Dial Access? y Busy Threshold: 255 Night Service: Queue Length: 0 Service Type: tie Auth Code? n TestCall ITC: rest Far End Test Line No: TestCall BCC: 4 ```
2.	Enter the **add signaling-group** <**s**> command, where **s** is an available signaling group and configure as follows: • **Group Type** – Set to **isdn-pri**. • **Primary D-Channel** – Set to **01A0724**. • **Trunk Group for Channel Selection** – Set to 41, the trunk group created in **Step 1**. ``` add signaling-group 41 Page 1 of 5 SIGNALING GROUP Group Number: 41 Group Type: isdn-pri Associated Signaling? y Max number of NCA TSC: 0 Primary D-Channel: 01A0724 Max number of CA TSC: 0 Trunk Group for NCA TSC: Trunk Group for Channel Selection:41 Supplementary Service Protocol: a ```

Step	Description
3.	Enter **change trunk-group** <**t**> command, where **t** is the trunk group created in **Step 1** and go to **Page 5** of the **trunk-group** form. Add 15 ports along with signaling group created in **Step 2**.

```
change trunk-group 41                                            Page   5 of  21
                              TRUNK GROUP
                                 Administered Members (min/max):   0/0
GROUP MEMBER ASSIGNMENTS                   Total Administered Members:   0

         Port    Code Sfx Name        Night         Sig Grp
  1: 01a0701  TN464  G                                41
  2: 01a0702  TN464  G                                41
  3: 01a0703  TN464  G                                41
  4: 01a0704  TN464  G                                41
  5: 01a0705  TN464  G                                41
  6: 01a0706  TN464  G                                41
  7: 01a0707  TN464  G                                41
  8: 01a0708  TN464  G                                41
  9: 01a0709  TN464  G                                41
 10: 01a0710  TN464  G                                41
 11: 01a0711  TN464  G                                41
 12: 01a0712  TN464  G                                41
 13: 01a0713  TN464  G                                41
 14: 01a0714  TN464  G                                41
 15: 01a0715  TN464  G                                41
```

Step	Description
4.	Go to **Page 6** of the **trunk-group** form and enter remaining 8 ports. Port **24** is used for signaling.

```
change trunk-group 41                                            Page   6 of  21
                              TRUNK GROUP
                                 Administered Members (min/max):   0/0
GROUP MEMBER ASSIGNMENTS                   Total Administered Members:   0

         Port    Code Sfx Name        Night         Sig Grp
 16: 1a0716   TN464  G                                41
 17: 1a0717   TN464  G                                41
 18: 1a0718   TN464  G                                41
 19: 1a0719   TN464  G                                41
 20: 1a0720   TN464  G                                41
 21: 1a0721   TN464  G                                41
 22: 1a0722   TN464  G                                41
 23: 1a0723   TN464  G                                41
 24:
 25:
 26:
 27:
 28:
 29:
 30:
```

Step	Description
5.	Repeat **Steps 1-4** to configure trunks in Avaya G350.

3.4. Configuring Dial Plan/Routing

To route the calls properly between the two PBXs, a uniform dial plan is created. A route pattern is defined to handle the calls which match a certain criteria for the Called Party Number.

Step	Description

1.	Enter the **change uniform-dialplan** <**u**>, where **u** is the matching pattern and configure as follows:
	• **Matching Pattern** – Pattern to match for the Called Party Number. Set to **5** for this compliance test.
	• **Len** – Length of the Called Party Number.
	• **Net** – Set to **aar**.
	
	<pre>change uniform-dialplan 5 Page 1 of 2
	                      UNIFORM DIAL PLAN TABLE
	                                                       Percent Full: 0
	
	  Matching Insert Node
	  Pattern Len Del Digits Net Conv Num
	  5 5 0 aar n</pre>

2.	Enter the **change route-pattern** <**r**> command, where **r** is route pattern and configure as follows:
	• **Grp No** – Set to **41**, trunk group created in **Section 3.3**, **Step 1**.
	• **FRL** – Set to **0**.
	
	<pre>change route-pattern 41 Page 1 of 3
	                 Pattern Number: 41 Pattern Name:
	
	   Grp FRL NPA Pfx Hop Toll No. Inserted DCS/ IXC
	   No Mrk Lmt List Del Digits QSIG
	                            Dgts Intw
	 1: 41 0 n user
	 2: n user
	 3: n user
	 4: n user
	 5: n user
	 6: n user
	
	     BCC VALUE TSC CA-TSC ITC BCIE Service/Feature BAND No. Numbering LAR
	     0 1 2 3 4 W Request Dgts Format
	                                                             Subaddress
	 1: y y y y y n n rest none
	 2: y y y y y n n rest none
	 3: y y y y y n n rest none
	 4: y y y y y n n rest none
	 5: y y y y y n n rest none
	 6: y y y y y n n rest none</pre>

Step	Description

3.	Enter **change aar analysis** <**a**> command, where **a** is dialed string of the Called Party Number and configure as follows:
	• **Dialed String** – Partial or completely dialed number string.
	• **Total Min** – Minimum number of digits in the dialed string. Set to **5** for this compliance testing.
	• **Total Max** – Maximum number of digits in the dialed string. Set to **5** for this compliance testing.
	• **Route Pattern** – Set to **41**, the route pattern created in **Step 2**.
	• **Call Type** – Set to **aar**.
	
	<pre>change aar analysis 5 Page 1 of 2
	                      AAR DIGIT ANALYSIS TABLE
	                                                      Percent Full: 6
	
	        Dialed Total Route Call Node ANI
	        String Min Max Pattern Type Num Reqd
	        5 5 5 41 aar n</pre>

4.	Repeat **Steps 1-3** to configure dial plan and routing in Avaya G350.

3.5. Configuring T1 QSIG Trunks

The configuration for setting up a T1 QSIG trunk is similar to the T1 ISDN PRI trunk. The only changes are to the DS1 form.

Step	Description

1.	Enter the **change ds1 1a07** and configure as follows on Avaya G650:
	• **Name** – Set to any descriptive string.
	• **Line Coding** – Set to **b8zs**.
	• **Framing Mode** – Set to **esf**.
	• **Signaling Mode** – Set to **isdn-pri**.
	• **Connect** – Set to **pbx**.
	• **Interface** – Set to **peer-master**.
	
	<pre>change ds1 1a07 Page 1 of 2
	                              DS1 CIRCUIT PACK
	
	            Location: 01A07 Name: T1 QSIG
	            Bit Rate: 1.544 Line Coding: b8zs
	    Line Compensation: 1 Framing Mode: esf
	        Signaling Mode: isdn-pri
	              Connect: pbx Interface: peer-master
	    TN-C7 Long Timers? n Peer Protocol: Q-SIG
	  Interworking Message: PROGress Side: b
	  Interface Companding: mulaw CRC? n
	            Idle Code: 11111111
	                              DCP/Analog Bearer Capability: 3.1kHz
	
	                                        T303 Timer(sec): 4
	
	        Slip Detection? n Near-end CSU Type: other</pre>

Step	Description
2.	Enter the **change ds1 1v5** command and configure as follows for Avaya G350: • **Name** – Set to any descriptive string. • **Line Coding** – Set to **b8zs**. • **Framing Mode** – Set to **esf**. • **Signaling Mode** – Set to **isdn-pri**. • **Connect** – Set to **pbx** • **Interface** – Set to **peer-slave**.

```
change ds1 1v5                                              Page   1 of   2
                              DS1 CIRCUIT PACK


              Location: 001V5                          Name: T1 QSIG
              Bit Rate: 1.544                   Line Coding: b8zs
      Line Compensation: 1                       Framing Mode: esf
         Signaling Mode: isdn-pri
                Connect: pbx                        Interface: peer-slave
      TN-C7 Long Timers? n              Country Protocol: 1
  Interworking Message: PROGress        Protocol Version: a
 Interface Companding: mulaw                        CRC? n
             Idle Code: 11111111
                              DCP/Analog Bearer Capability: 3.1kHz

                                     T303 Timer(sec): 4



         Slip Detection? n            Near-end CSU Type: other
```

3.6. Configuring T1 Robbed-Bit Trunks

The following screens show how to configure a DS1 card for T1 robbed-bit. No signaling group needs to be specified as robbed-bit signaling method uses bits from each of the 24 DS-0 channels. In cases where a previously configured DS1 card is used, then the DS1 card and its associated trunk and signaling groups should be removed prior to configuring the DS1 card for T1 robbed-bit.

Step	Description

1.	Enter the **add ds1 1a07** command and configure as follows for Avaya G650:
	• **Name** – Set to any descriptive string.
	• **Line Coding** – Set to **b8zs**.
	• **Framing Mode** – Set to **esf**.
	• **Signaling Mode** – Set to **robbed-bit**.
	
	<pre>add ds1 1a07 Page 1 of 2
	                          DS1 CIRCUIT PACK
	
	           Location: 01A09 Name: T1 Robbed Bit
	           Bit Rate: 1.544 Line Coding: b8zs
	   Line Compensation: 1 Framing Mode: esf
	      Signaling Mode: robbed-bit
	7
	
	Interface Companding: mulaw
	          Idle Code: 11111111
	
	      Slip Detection? n Near-end CSU Type: other</pre>

Step	Description

2.	Enter the **add trunk-group** <t>, where **t** is an available trunk group and configure as follows:
	• **Group Type** – Set to **tie**.
	• **Group Name** – Set to any descriptive string.
	• **TAC** – Enter any value per the dial plan. Set to **141** for this compliance testing.
	• **Trunk Type** – Set to **wink/wink**.
	
	<pre>add trunk-group 41 Page 1 of 20
	                            TRUNK GROUP
	
	Group Number: 41 Group Type: tie CDR Reports: y
	  Group Name: T1 Robbed Bit COR: 1 TN: 1 TAC: 141
	   Direction: two-way Outgoing Display? n Trunk Signaling Type:
	 Dial Access? n Busy Threshold: 255 Night Service:
	Queue Length: 0 Incoming Destination:
	   Comm Type: voice Auth Code? n
	                            Trunk Flash? N
	
	Trunk Type: wink/wink</pre>

3.	Go to **Page 5** of the **trunk-group** form and add 15 ports.
	
	<pre>add trunk-group 41 Page 5 of 21
	                            TRUNK GROUP
	                                 Administered Members (min/max): 0/0
	GROUP MEMBER ASSIGNMENTS Total Administered Members: 0
	
	       Port Code Sfx Name Night Mode Type Ans Delay
	  1: 01A0701 TN464 G
	  2: 01A0702 TN464 G
	  3: 01A0703 TN464 G
	  4: 01A0704 TN464 G
	  5: 01A0705 TN464 G
	  6: 01A0706 TN464 G
	  7: 01A0707 TN464 G
	  8: 01A0708 TN464 G
	  9: 01A0709 TN464 G
	 10: 01A0710 TN464 G
	 11: 01A0711 TN464 G
	 12: 01A0712 TN464 G
	 13: 01A0713 TN464 G
	 14: 01A0714 TN464 G
	 15: 01A0715 TN464 G</pre>

Step	Description
4.	Go to **Page 6** of the **trunk-group** form and enter remaining 9 ports. ``` add trunk-group 41 Page 6 of 21 TRUNK GROUP Administered Members (min/max): 0/0 GROUP MEMBER ASSIGNMENTS Total Administered Members: 0 Port Code Sfx Name Night Mode Type Ans Delay 16: 01A0716 TN464 G 17: 01A0717 TN464 G 18: 01A0718 TN464 G 19: 01A0719 TN464 G 20: 01A0720 TN464 G 21: 01A0721 TN464 G 22: 01A0722 TN464 G 23: 01A0723 TN464 G 24: 01A0724 TN464 G 25: 26: 27: 28: 29: 30: ```
5.	Repeat **Step 1-4** for Avaya G350.

3.7. Configuring T1 Common-Channel Trunks

The following screens show how to configure a DS1 card for T1 common channel. No signaling group needs to be specified as common channel signaling method is used. Only configuration for DS1 card is shown here as the trunks and its members are added the same way as for robbed bit signaling in Section 3.6 except port 24 is used for signaling. In cases where a previously configured DS1 card is used, then the DS1 card and its associated trunk and signaling groups should be removed prior to re-configuring the DS1 card.

Step	Description

1.	Enter the **add ds1 1a07** command and configure as follows for Avaya G650:
	• **Line Coding** – Set to **b8zs**.
	• **Framing Mode** – Set to **esf**.
	• **Signaling Mode** – Set to **common-chan**.
	
	`add ds1 1a07` `Page   1 of   2`
	`DS1 CIRCUIT PACK`
	
	`        Location: 01A09                        Name: T1-RBS`
	`        Bit Rate: 1.544                 Line Coding: b8zs`
	`Line Compensation: 1                    Framing Mode: esf`
	`   Signaling Mode: common-chan`
	
	`Interface Companding: mulaw`
	`         Idle Code: 11111111`
	`           DMI-BOS? n`
	
	`    Slip Detection? n              Near-end CSU Type: other`

Step	Description

2.	Enter the **add trunk-group** <t>, where **t** is an available trunk group and configure as follows:
	• **Group Type** – Set to **tie**.
	• **Group Name** – Set to any descriptive string.
	• **TAC** – Enter any value per the dial plan. Set to **141** for this compliance testing.
	• **Trunk Type** – Set to **wink/wink**.
	
	<pre>add trunk-group 41 Page 1 of 20
	                            TRUNK GROUP
	
	Group Number: 41 Group Type: tie CDR Reports: y
	  Group Name: T1 Common Channel COR: 1 TN: 1 TAC: 141
	    Direction: two-way Outgoing Display? n Trunk Signaling Type:
	 Dial Access? n Busy Threshold: 255 Night Service:
	Queue Length: 0 Incoming Destination:
	   Comm Type: voice Auth Code? n
	                                  Trunk Flash? N
	
	   Trunk Type: wink/wink</pre>

3.	Repeat **Step 1-2** for Avaya G350.

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4. Configuring RAD Vmux Gateway

RAD Vmux can be configured using either a Hyper Terminal or a telnet session. The following screens show the T1 configuration. Vmux configuration should match the local PBX configuration. Vmux-2100 comes with 4 slots. Each slot can be configured for either T1 or E1. Therefore, Vmux-2100 can be configured for 4 T1 slots, 4 E1 slots or combination. Each T1 / E1 slot consists of 4 T1 / 4 E1 ports. The first two T1 / E1 ports are called **group 1** and the next two are called **group 2.** The first port of each group is assigned as **External 1** and the second port as **External 2**. To configure Vmux gateway, telnet to the device, using a proper user name and password. At any given time, and especially after a configuration change, it is recommended to save the DB changes by pressing the '@' (shift+'2') key.

Vmux-110 will be configured in a similar way.

4.1. Configuring T1 ISDN PRI or QSIG

Step	Description
1.	At the **Main Menu** screen (Not shown), navigate to the **Configuration → Systems → Management** page and configure the IP address, Subnet Mask, and Default Gateway of the device. ``` 1. Set Host IP address > (192.45.80.230) 2. Set Subnet Mask > (255.255.255.128) 3. Set Default Gateway > (192.45.80.1) 4. Read > (public) 5. Write > (private) 6. Trap > (public) ```
2.	Navigate to the **Configuration → Slot 1 → Group 2 → Bundles Parameters -> Bundle Configuration** page. Add / enable the bundle (bundle 1). The following screen shows the bundle configuration. The important parameters are highlighted. ``` 1. Enter Bundle Number [1 - 30]> (1) 2. Connect> (Yes) 3. Function> (TDMoIP+) 4. Routing Parameters 5. Max Bytes In Multiplexed Frame [100 - 1461]> (1400) 6. Packetizing Interval (msec) [10 - 90]> (30) 7. Packet Redundancy [1 -4]> (1) 8. Connectivity Parameters 9. Voice Parameters 10. Transparent Jitter Size (N x 10mSec)[2 - 10]> (2) 11. CAS Redundancy (Disable) 12. Bundle Name> () ```

Step	Description
3.	Configure the routing parameters of each Vmux gateway. This enables one Vmux gateway to know about the other Vmux gateway. Navigate to the **Configuration → Slot 1 → Group 2 → Bundle Parameters→ Bundle Configuration -> Routing Parameters** page.

```
1. Destination IP           >    (192.45.83.3)
2. Next hop                 >    (0.0.0.0)
3. Destination Bundle[1 - 30]>   (1)
4. TOS Parameters
5. VLAN Parameters
```

4.	Configure the Voice Parameters. Navigate to the **Configuration → Slot 1 → Group 2 → Bundle Parameters → Bundle Configuration -> Voice Parameters** page. The Coder/Rate indicates the codec used between the two Vmux gateways. The compression codec on the Vmux should match the one on the PBX. The coding should match with the Interface Companding field on Avaya PBX DS1 form.

```
1. Coder/Rate (kbps)    >    (G.729A/8)
2. Caller ID
3. Tx Gain              >    (0 dB )
4. Rx Gain > (0 dB)
5. Fax/Modem
6. MF Parameters
7. Custom Tone Detection
8. Super Tandem         >    (Disable)
9. VAD   10. CNG mode        >    (On )
10. Coding              >    (U-Law)
```

5.	Configure the T1 Parameter. Navigate to the **Configuration → Card → Slot 1 → Group 2 → External 1** page.

```
1. Connect                  >    (Yes)
2. Clock Mode               >    (Lbt        (Local))
3. Frame                    >    (Esf)
4. Interface Type           >    (Dsu)
5. Line Code                >    (B8ZS)
6. Line Length              >    (0-133 Feet)
7. Restoration Time         >    (1 Second (Fast))
8. Idle Code        [0 - ff] >    (ff)
9. Signaling                >    (CCS)
10. TS Rate (Kbps)          >    (64 KBPS)
```

Step	Description
6.	Navigate to the **Configuration → Card → Slot 1 → Group 2 → External 1 → Distribution Of Framer Time Slots → Time Slots Configuration** page to configure the T1 time slots allocation.

```
1. Update from Time Slot [1 - 24]...  (1)
2. To Time Slot [1 - 24]... (23)
3. Type > (Voice)
4. Bundle [1 - 30]... (1)
5. Destination Port ID [1 - 4]... (1)
6. Destination Time Slot ID [1 - 24]... (1)
7. Update Time Slot
```

```
1. Update from Time Slot [1 - 24]...  (24)
2. To Time Slot [1 - 24]... (24)
3. Type > (HDLC-1)
4. Bundle [1 - 30]... (1)
5. Destination Port ID [1 - 4]... (1)
6. Destination Time Slot ID [1 - 24]... (24)
7. Destination HDLC Ch ID    > (HDLC-1)
8. Update Time Slot
```

Step	Description
7.	Check the resulting timeslot configuration by selecting the **Configuration → Card → Slot 1 → Group 2 → External 1 → Distribution Of Framer Time Slots → Display Time Slots Configuration** page.

```
Display Time Slots

    Ts#          Type       Bundle  Dest Port    Dest Ts
    1           Voice         1         1           1
    2           Voice         1         1           2
    3           Voice         1         1           3
    4           Voice         1         1           4
    5           Voice         1         1           5
    .             .           .         .           .
    .             .           .         .           .
    .             .           .         .           .
    20          Voice         1         1           20
    21          Voice         1         1           21
    22          Voice         1         1           22
    23          Voice         1         1           23
    24          HDLC-1        1         1           24
```

4.2. Configuring T1 Robbed-Bit

Step	Description
1.	Configuring T1 robbed-bit is similar to ISDN-PRI or QSIG. Navigate to the **Configuration → Slot 1 → Group 2 → External 1** page. ``` 1. Connect > (Yes) 2. Clock Mode > (Lbt (Local)) 3. Frame > (Esf) 4. Interface Type > (Dsu) 5. Line Code > (B8ZS) 6. Line Length > (0-133 Feet) 7. Restoration Time > (1 Second (Fast)) 8. Idle Code [0 - ff]> (ff) 9. Signaling > (Robbed Bit MF) 10. TS Rate (Kbps) > (64 KBPS) 11. Profile [1 - 4]> (1) ```
2.	Navigate to the **Configuration → Card → Slot 1 → Group 2 → External 1 → Distribution Of Framer Time Slots → Time Slots Configuration** page to configure the T1 time slots allocation. ``` 1. Update from Time Slot [1 - 24]... (1) 2. To Time Slot [1 - 24]... (24) 3. Type > (Voice) 4. Bundle [1 - 30]... (1) 5. Destination Port ID [1 - 4]... (1) 6. Destination Time Slot ID [1 - 24]... (1) 7. Update Time Slot ```
3.	Check the resulting timeslot configuration by selecting the **Configuration → Card → Slot 1 → Group 2 → External 1 → Distribution Of Framer Time Slots → Display Time Slots Configuration** page. ``` Display Time Slots Ts# Type Bundle Dest Port Dest Ts 1 Voice 1 1 1 2 Voice 1 1 2 3 Voice 1 1 3 4 Voice 1 1 4 5 Voice 1 1 5 . . . . 20 Voice 1 1 20 21 Voice 1 1 21 22 Voice 1 1 22 23 Voice 1 1 23 24 Voice 1 1 24 ```

4.3. Configuring T1 Common-Channel

Step	Description
1.	Configuring T1 common-channel is similar to ISDN-PRI or QSIG. The only page that is different is the **Configuration → Slot 1 → Group 2 → Bundle 1** page.

	<pre>1. Enter Bundle Number [1 - 30]> (1)
	2. Connect> (Yes)
	3. Function> (TDMoIP+)
	4. Routing Parameters
	5. Max Bytes In Multiplexed Frame [100 - 1461]> (1400)
	6. Packetizing Interval (msec) [10 - 90]> (10)
	7. Packet Redundancy [1-4]> (1)
	8. Connectivity Parameters
	9. Voice Parameters
	10. Transparent Jitter Size (N x 10mSec)[2 - 10]> (2)
	11. CAS Redundancy (Disable)
	12. Bundle Name> (tst-bndl)</pre>

2.	Configure the T1 Parameter. Navigate to the **Configuration → Slot 1 → Group 2 → External 1** page. The important parameters that are different from the default values are highlighted.

	<pre>1. Connect > (Yes)
	2. Clock Mode > (Lbt (Local))
	3. Frame > (Esf)
	4. Interface Type > (Dsu)
	5. Line Code > (B8ZS)
	6. Line Length > (0-133 Feet)
	7. Restoration Time > (1 Second (Fast))
	8. Idle Code[1 - ff]... (ff)
	9. Signaling > (CCS)
	10. TS Rate (Kbps) > (64 KBPS)</pre>

Step	Description
3.	Navigate to the **Configuration → Card → Slot 1 → Group 2 → External 1 → Distribution Of Framer Time Slots → Time Slots Configuration** page to configure the T1 time slots allocation. ``` Time Slot Configuration >Slot 1> Group 2> External 1 1. Update from Time Slot [1 - 24]... (1) 2. To Time Slot [1 - 24]... (23) 3. Type > (Voice) 4. Bundle [1 - 30]... (1) 5. Destination Port ID [1 - 4]... (1) 6. Destination Time Slot ID [1 - 24]... (1) 7. Update Time Slot ``` ``` Time Slot Configuration >Slot 1> Group 2> External 1 1. Update from Time Slot [1 - 24]... (24) 2. To Time Slot [1 - 24]... (24) 3. Type > (TRNSPT) 4. Bundle [1 - 30]... (1) 5. Destination Port ID [1 - 4]... (1) 6. Destination Time Slot ID [1 - 24]... (24) 7. Update Time Slot ```
4.	Check the resulting timeslot configuration by selecting the **Configuration → Card → Slot 1 → Group 2 → External 1 → Distribution Of Framer Time Slots → Display Time Slots Configuration** page. ``` Display Time Slots Ts# Type Bundle Dest Port Dest Ts 1 Voice 1 1 1 2 Voice 1 1 2 3 Voice 1 1 3 . . . . 20 Voice 1 1 20 21 Voice 1 1 21 22 Voice 1 1 22 23 Voice 1 1 23 24 TRNSPT 1 1 24 ```

5. Interoperability Compliance Testing

Interoperability compliance testing covered connectivity, error recovery, and feature functionality. Feature functionality testing verified the ability of Vmux TDM over IP solution to provide PBX to PBX communication and make, receive, transfer, and conference calls. Connectivity functionality testing verified that Vmux gateways were able to connect Avaya G650 and Avaya G350 gateways over T1 using ISDN PRI, QSIG, robbed-bit and common channel.

5.1. General Test Approach

All test cases were performed manually. For each T1 configuration the direct connection between the Avaya G650 and Avaya G350 were tested first. Once, calls could be made between two sites, then, Vmux devices were introduced to verify the operation. The following features and functionality were verified:

- T1 connectivity with ISDN-PRI
- T1 connectivity with QSIG
- T1 connectivity with robbed-bit
- T1 connectivity with common-channel
- Transfers and Conference calls
- Modem Calls
- Codec Sets G.711MU, G729A and G723.1
- FAX with various bandwidths
- DTMF
- Vmux 110 in place of Vmux 2100

5.2. Test Results

All test cases passed. Vmux provided connectivity between Avaya G650 and G350 gateways over T1. During the test, no problems were encountered.

6. Verification Steps

To verify that the solution is properly configured in the field, the following steps can be taken.

After Vmux gateways are connected, make sure that the physical connection (Layer 2) is good by executing **test board 1AXX**, where **1** is the cabinet ID, **A** is the carrier ID and **XX** is the slot number of the DS1 board.

If the connection is OK, check the trunk status by running "**status trunk YY**" where YY is the trunk-group number.

Place calls between Site A and Site B to verify proper connectivity. Fax machines were utilized at Site A and Site B to verify proper operation (Tested with 4.8Kbps, 9.6Kbps and 14.4Kbps).

7. Support

For technical support on Vmux, call RAD Data Communications Support at (800)444-7234 or send email to techsup@radusa.com.

8. Conclusion

These Application Notes describe a solution for integrating RAD Data Communications Vmux Gateways with Avaya Communication Manager on two different media gateways, Avaya G650 and Avaya G350. RAD Vmux Gateways are connected to Avaya gateways through a T1 interface. RAD Vmux Gateway is a TDM over IP gateway that enables the TDM T1/E1 circuits to be extended over an IP/Ethernet network. The systems interoperated successfully, providing a suitable solution for TDMoIP in the PBX-to-PBX environment.

9. References

This section references the Avaya and RAD Data Communications documentation that are relevant to these Application Notes.

The following Avaya product documentation can be found at http://support.avaya.com.

[1] *Administration for Network Connectivity for Avaya Communication Manager*, Issue 13, January 2008, Document Number 555-233-504
[2] *Administrator's Guide for Avaya Communication Manager*, Issue 4, January 2008, Document Number 03-300509

The following product documentation is provided by RAD Data Communications. For additional product and company information, visit http://www.radusa.com.

[3] *RAD Vmux-2100 Installation and Operation Manual*: Version 4
[4] *RAD Vmux-110 Installation and Operation Manual*: Version 4

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