



## **Configuring Avaya Communication Manager in a Centralized Avaya Gatekeeper Environment - Issue 1.0**

### **Abstract**

These Application Notes describe connectivity between a network of Avaya Media Servers running Avaya Communication Manager in a centralized gatekeeper environment using Avaya Gatekeepers. This is one approach to minimizing administrative complexity for enterprises deploying a large and growing number of IP-enabled PBXs and call servers.

# 1. Introduction

These Application Notes describe one approach to minimizing administrative complexity for enterprises deploying a large and growing number of IP-enabled PBXs and call servers. As the number of independent sites that need to be interconnected via the data WAN scales up, it may be desirable to:

- Minimize the configuration requirements (e.g., H.323 signaling groups and trunk groups) at each of the sites
- Centralize routing intelligence at fewer locations
- Manage admission of calls to the IP network more centrally
- Retain alternate routing paths such that calls denied admission to the enterprise IP network could automatically be completed via alternate PSTN routes.

The configuration described in these Application Notes is one approach to satisfying these objectives. Each IP-enabled PBX or call server, referred to as an “end system”, need only be configured for simple routing and IP Trunking to a site designated as its “regional gatekeeper”. Regional gatekeeper(s) require routing and IP Trunk provisioning only to the end systems in their region and one or more peer regional gatekeepers. This arrangement obviates the need for a mesh configuration, where each node on the network needs an awareness of all other nodes.

The arbitration of whether a new call request should be allowed to traverse the enterprise IP network can be managed by the regional gatekeepers. The regional gatekeepers use the Avaya Communication Manager Call Admission Control feature to monitor network utilization, either by number of calls or by bandwidth utilization. If the regional gatekeeper denies admission of the call to the IP network based on configured thresholds, the call signaling that rejects the call back to the “end system” can result in the automatic re-routing of the call over local PSTN trunks in the end systems, if desired. The Avaya Communication Manager Look-ahead Routing feature enables the end systems to automatically re-route calls when network congestion is encountered on the preferred IP trunk paths.

In **Figure 1**, the Avaya DEFINITY® Server R (US1) and the Avaya DEFINITY® Server R (US2) are “end systems” whose “regional gatekeeper” (GK1) is a site with an Avaya S8700 Media Server pair. The second regional gatekeeper (GK2) is a site with an Avaya S8500 Media Server, and GK2 provides services for the end system with the S8700 Media Server pair (UK2). The sites are labeled to suggest an example approach where US PBX sites are spokes on the left, with GK1 serving as a regional US gatekeeper hub. Sites on the right are UK PBX sites with GK2 serving as a regional UK hub. Obviously, customer circumstances will vary.

Two basic topologies are supported in an Avaya centralized gatekeeper environment, fully interconnected as well as hub and spoke. Combinations of these topologies are also supported. The configuration covered here is two adjacent hub and spoke configurations.

The configuration steps covered in these Application Notes focus on the trunking, signaling, and call management connectivity between the locations. **Figure 1** shows a logical representation of the connections between the Gateways and Gatekeepers. There are two signaling groups and trunk groups between location US1 and Gatekeeper 1. This was simply done for redundancy. There is only one signaling group and trunk group between all other systems. A LAN infrastructure was used to physically interconnect the PBXs, but this was a standard configuration, that supported QoS, and is beyond the scope of these Application Notes.

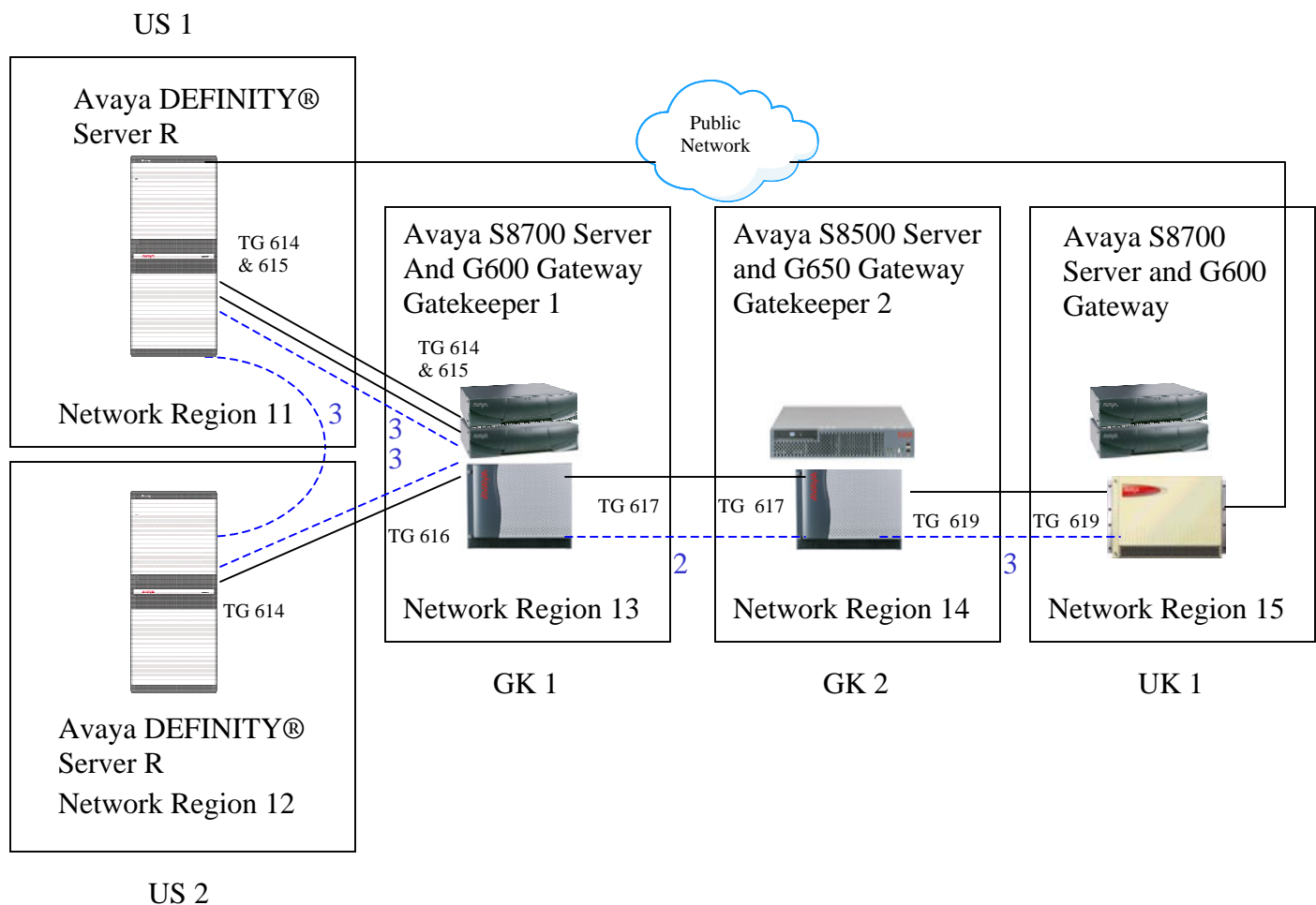
The call flow between location US1 and US2 is as follows:

- 1) Communication Manager in location US1 sends a call request to Gatekeeper 1.
- 2) Gatekeeper 1 determines if the Call Admission Control limit between Gatekeeper 1 and location US2 has been reached. If the limit has been reached, the call request is rejected, and Communication Manager in location US1 can use Look Ahead Routing (LAR) to find an alternate path to location US2. If the limit has not been reached, Gatekeeper 1 sends a call request to location US2.
- 3) When Communication Manager in location US2 accepts the call, if the call shuffles, between US1 and US2 (or the endpoints), Gatekeeper 1 makes note of the direct utilization between US1 and US2. If the call does not shuffle, Gatekeeper 1 makes note of the utilization for its path to US1 and its path to US2.

The call flow between location US1 and UK1 is as follows:

- 1) Communication Manager in location US1 sends a call request to Gatekeeper 1.
- 2) Gatekeeper 1 determines if the Call Admission Control limit between Gatekeeper 1 and Gatekeeper 2 has been reached. If the limit has been reached, the call request is rejected, and Communication Manager in location US1 can use Look Ahead Routing (LAR) to find an alternate path to location UK1. If the limit has not been reached, Gatekeeper 1 sends a call request to Gatekeeper 2.
- 3) Gatekeeper 2 determines if the Call Admission Control limit between Gatekeeper 2 and UK1 has been reached. If the limit has been reached, the call request is rejected all the way back to US1, and Communication Manager in location US1 can use Look Ahead Routing (LAR) to find an alternate path to location UK1. If the limit has not been reached, Gatekeeper 2 sends a call request to UK1.
- 4) When Communication Manager in UK1 accepts the call, whether or not the call shuffles, Gatekeeper 1 makes note of the utilization for its path to US1 and its path to Gatekeeper 2, and Gatekeeper 2 makes note of the utilization for its path to UK1 and its path to Gatekeeper 1.

While the calls are being set up, resources at the gatekeepers are being utilized, so there should be sufficient C-LAN and MEDPRO resources in the gatekeepers to support calls flowing through them. Even when calls shuffle, trunk port members are allocated in each of the associated trunk groups, so there should be sufficient members in the trunk groups to support all calls.



**Notes:**

- Indicates the number of calls allowed by Call Admission Control between regions.
- Region 11 to 12 allows 3 shuffled/direct calls.
- Region 11 to 12 allows 3 tandem calls (without shuffling) through Gatekeeper 1.
- Region 11 to 15 or 12 to 15 allows 2 calls (the bottleneck is between the Gatekeepers).

**Figure 1: Logical Network Configuration**

## 2. Equipment and Software Validated

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

Quantity	Device Description	Version
2	Avaya DEFINITY® Server R	R011.r.03.1.535 (1.3.1)
1	Avaya S8700/G600 Server/Gateway	R011x.03.1.535 (1.3.1)
1	Avaya S8700/G600 Server/Gateway (GK1)	R012x.01.0.411.7 (2.1)
1	Avaya S8500/G650 Server/Gateway (GK2)	R012x.01.0.411.7 (2.1)
4	Avaya 8410 Digital Telephones	N/A
4	Avaya 4612 IP Telephone	1.8
4	Avaya 4620 IP Telephone	2.0

## 3. Configuration

The configuration steps covered in these Application Notes focus on the trunking, signaling, and call management connectivity for Avaya Communication Manager at the different locations.

### 3.1. Configuring the Avaya S8700 Server and G600 Gateway serving as Gatekeeper 1

Gatekeeper 1 had 2 C-LAN and 2 MEDPRO cards, assigned to VLAN 50, and in Network Region 13.

1.	Add Node Names for Gatekeeper 1's C-LAN and MEDPRO cards, and assign them the appropriate IP Address. Add Node Names for the remote C-LANs to which Gatekeeper 1 will have signaling groups.
	<pre>change node-names ip                                 IP NODE NAMES       Name                    IP Address G3R1-CLAN1                   60 .1 .1 .10 G3R1-CLAN2                   70 .1 .1 .10 G3R2-CLAN1                   40 .1 .1 .10 GK1-CLAN1                    50 .1 .1 .10 GK1-CLAN2                    50 .1 .1 .20 GK1-MEDPRO1                  50 .1 .1 .11 GK1-MEDPRO2                  50 .1 .1 .21 GK2-CLAN1                    30 .1 .1 .10 default                      0 .0 .0 .0 procr                        . . .</pre>

2. Add IP Interfaces for the local C-LAN cards. The first C-LAN is located in slot a04. The “Node Name” must match the one assigned in the Node Names form. Assign the appropriate “Network Region” and “VLAN” (in this case 13 and 50 respectively). Set the “Enable Ethernet Port” field to “y”.

```
add ip-interface a04
```

#### IP INTERFACES

Type: C-LAN	ETHERNET OPTIONS
Slot: 01A04	Auto? n
Code/Suffix: TN799 D	Speed: 100Mbps
Node Name: GK1-CLAN1	Duplex: Full
IP Address: 50 .1 .1 .10	
Subnet Mask: 255.255.255.0	
Gateway Address: 50 .1 .1 .1	
Enable Ethernet Port? y	
Network Region: 13	
VLAN: 50	

Number of CLAN Sockets Before Warning: 400

The second C-LAN is located in slot a07.

```
add ip-interface a07
```

#### IP INTERFACES

Type: C-LAN	ETHERNET OPTIONS
Slot: 01A07	Auto? n
Code/Suffix: TN799 D	Speed: 100Mbps
Node Name: GK1-CLAN2	Duplex: Full
IP Address: 50 .1 .1 .20	
Subnet Mask: 255.255.255.0	
Gateway Address: 50 .1 .1 .1	
Enable Ethernet Port? y	
Network Region: 13	
VLAN: 50	

Number of CLAN Sockets Before Warning: 400

3. Add IP Interfaces for the local MEDPRO cards. The first MEDPRO is located in slot a05. The IP Interface for a MEDPRO is configured in the same way as for a C-LAN.

```
add ip-interface a05
```

IP INTERFACES

Type: MEDPRO	ETHERNET OPTIONS
Slot: 01A05	Auto? n
Code/Suffix: TN2302	Speed: 100Mbps
Node Name: GK1-MEDPRO1	Duplex: Full
IP Address: 50 .1 .1 .11	
Subnet Mask: 255.255.255.0	
Gateway Address: 50 .1 .1 .1	
Enable Ethernet Port? y	
Network Region: 13	
VLAN: 50	

The second MEDPRO is located in slot a08.

```
add ip-interface a08
```

IP INTERFACES

Type: MEDPRO	ETHERNET OPTIONS
Slot: 01A08	Auto? n
Code/Suffix: TN2302	Speed: 100Mbps
Node Name: GK1-MEDPRO2	Duplex: Full
IP Address: 50 .1 .1 .21	
Subnet Mask: 255.255.255.0	
Gateway Address: 50 .1 .1 .1	
Enable Ethernet Port? y	
Network Region: 13	
VLAN: 50	

4. Add a data module for each C-LAN. Select a unique “Data Extension” and “Link” for each data module. Note that the “Name” for the data module does not need to match the “Node Name” associated with the C-LAN. The association is done by the port field, which is a combination of the slot (01A04) and the signaling port (17). Set the “Type” field to “ethernet”.

```
add data-module 20000
                                DATA MODULE
Data Extension: 20000          Name: CLAN1
Type: ethernet
Port: 01A0417
Link: 1
```

Network uses 1's for Broadcast Addresses? y

```
add data-module 20001
                                DATA MODULE
Data Extension: 20001          Name: GK1-CLAN2
Type: ethernet
Port: 01A0717
Link: 2
```

Network uses 1's for Broadcast Addresses? y



5. There are 2 signaling groups between Gatekeeper 1 and Avaya G3R Server 1. When adding a signaling group, the “Trunk Group for Channel Selection” field must be left blank until the trunk group is configured. After the trunk group is configured use the “change signaling-group 1” command to populate the trunk group number. The “Supplementary Service Protocol” field was set to “b” to use QSIG signaling, but QSIG is not required for this configuration to work. The “Near-end Node Name” field should be set to the node name of a local C-LAN. The “Far-end Node Name” field should be set to the node name of a remote C-LAN. The “Near-End Listen Port” and “Far End Listen Port” should be “1719”. The “Far-End Network Region” associated with Avaya G3R Server 1 is “11”. “LRQ Required” should be set to “y”. “Direct IP-IP Audio Connections” and “IP Audio Hairpinning” should be set to “y”.

```
add signaling-group 1
```

SIGNALING GROUP

Group Number: 1

Group Type: h.323

Remote Office? n

Max number of NCA TSC: 0

SBS? n

Max number of CA TSC: 0

Trunk Group for NCA TSC:

Trunk Group for Channel Selection: 614

Supplementary Service Protocol: b

Near-end Node Name: GK1-CLAN1

Far-end Node Name: G3R1-CLAN1

Near-end Listen Port: 1719

Far-end Listen Port: 1719

Far-end Network Region: 11

LRQ Required? y

Calls Share IP Signaling Connection? n

RRQ Required? n

H245 Control Addr On FACility? n

Bypass If IP Threshold Exceeded? y

DTMF over IP: in-band

Direct IP-IP Audio Connections? y

IP Audio Hairpinning? y

Interworking Message: PROGRESS

```
add signaling-group 2
```

SIGNALING GROUP

Group Number: 2

Group Type: h.323

Remote Office? n

Max number of NCA TSC: 0

SBS? n

Max number of CA TSC: 0

Trunk Group for NCA TSC:

Trunk Group for Channel Selection: 615

Supplementary Service Protocol: b

Near-end Node Name: GK1-CLAN2

Far-end Node Name: G3R1-CLAN2

Near-end Listen Port: 1719

Far-end Listen Port: 1719

Far-end Network Region: 11

LRQ Required? y

Calls Share IP Signaling Connection? n

RRQ Required? n

H245 Control Addr On FACility? n

Bypass If IP Threshold Exceeded? y

DTMF over IP: in-band

Direct IP-IP Audio Connections? y

IP Audio Hairpinning? y

Interworking Message: PROGRESS

6. There are 2 trunk groups between Gatekeeper 1 and Avaya G3R Server 1. Trunk group 614 is shown here, which is associated with signaling group 1. Most of the fields are set to their defaults. Trunk group 615 is configured similarly and is associated with signaling group 2.

```
display trunk-group 614                                     Page 1 of 22
                                     TRUNK GROUP

Group Number: 614                      Group Type: isdn                      CDR Reports: y
Group Name: To G3R1                      COR: 1                      TN: 1          TAC: 136
Direction: two-way                      Outgoing Display? n          Carrier Medium: IP
Dial Access? n                          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
TRUNK PARAMETERS
Codeset to Send Display: 6              Codeset to Send National IEs: 6
Max Message Size to Send: 260          Charge Advice: none
Supplementary Service Protocol: b       Digit Handling (in/out): enbloc/enbloc

Trunk Hunt: ascend                      QSIG Value-Added? n
                                     Digital Loss Group: 18
Incoming Calling Number - Delete:      Insert:                      Format:
Bit Rate: 1200                      Synchronization: async      Duplex: full
Disconnect Supervision - In? y Out? n
Answer Supervision Timeout: 0
```

```
display trunk-group 614                                     Page 2 of 22
TRUNK FEATURES
ACA Assignment? n                      Measured: none              Wideband Support? n
                                     Internal Alert? n            Maintenance Tests? y
Data Restriction? n                    NCA-TSC Trunk Member: 1
Send Name: y                          Send Calling Number: y
Used for DCS? n                      Hop Dgt? n
Suppress # Outpulsing? n              Format: unknown
Outgoing Channel ID Encoding: preferred UUI IE Treatment: service-provider

Replace Restricted Numbers? n
Replace Unavailable Numbers? n
Send Connected Number: y
Modify Tandem Calling Number? n

Send UUI IE? y
Send UCID? n
Send Codeset 6/7 LAI IE? y

Path Replacement with Retention? n
Path Replacement Method: better-route
SBS? n Network (Japan) Needs Connect Before Disconnect? n
```

When entering the Port members, simply type "ip". After the form is submitted, virtual port numbers will be assigned by software. When the form is displayed, the virtual port value (i.e. "T00001") is displayed.

```
display trunk-group 614                                     Page 6 of 22
                                     TRUNK GROUP
Administered Members (min/max):      1/10
GROUP MEMBER ASSIGNMENTS              Total Administered Members: 10

Port   Code Sfx Name      Night      Sig Grp
1: T00001                1
2: T00002                1
3: T00003                1
4: T00004                1
```

7. Signaling group 3 and Trunk group 616 are used to connect Gatekeeper 1 to Avaya G3R Server 2. The signaling group and trunk group are configured as shown in previous steps. The signaling group is shown here to highlight the association of Network Region 12 with Avaya G3R Server 2.

```
display signaling-group 3

SIGNALING GROUP

Group Number: 3          Group Type: h.323
Remote Office? n        Max number of NCA TSC: 10
SBS? n                  Max number of CA TSC: 10
                        Trunk Group for NCA TSC: 616
Trunk Group for Channel Selection: 616
Supplementary Service Protocol: b

Near-end Node Name: GK1-CLAN1    Far-end Node Name: G3R2-CLAN1
Near-end Listen Port: 1719       Far-end Listen Port: 1719
Far-end Network Region: 12

LRQ Required? y               Calls Share IP Signaling Connection? n
RRQ Required? n               H245 Control Addr On FACility? n
                              Bypass If IP Threshold Exceeded? n

DTMF over IP: in-band          Direct IP-IP Audio Connections? y
                              IP Audio Hairpinning? y
                              Interworking Message: PROGRess
```

8. Signaling group 5 and Trunk group 617 are used to connect Gatekeeper 1 to Gatekeeper 2. The signaling group and trunk group are configured as shown in previous steps. The signaling group is shown here to highlight the association of Network Region 14 with Gatekeeper 2.

```
display signaling-group 5

SIGNALING GROUP

Group Number: 5          Group Type: h.323
Remote Office? n        Max number of NCA TSC: 0
SBS? n                  Max number of CA TSC: 0
                        Trunk Group for NCA TSC:
Trunk Group for Channel Selection: 617
Supplementary Service Protocol: b

Near-end Node Name: GK1-CLAN1    Far-end Node Name: GK2-CLAN1
Near-end Listen Port: 1719       Far-end Listen Port: 1719
Far-end Network Region: 14

LRQ Required? y               Calls Share IP Signaling Connection? n
RRQ Required? n               H245 Control Addr On FACility? n
                              Bypass If IP Threshold Exceeded? y

DTMF over IP: in-band          Direct IP-IP Audio Connections? y
                              IP Audio Hairpinning? y
                              Interworking Message: PROGRess
```

9. Call and Bandwidth limits are configured on page 3 of the IP Network Region form. Gatekeeper 1 is logically associated with Network Region 13. On Page 1 of the IP Network Region, set “Intra-region IP-IP Direct Audio” and “Inter-region IP-IP Direct Audio” to “yes. Set the “IP Audio Hairpinning” field to “y”.

```
display ip-network-region 13                                     Page 1 of 19

                                IP NETWORK REGION

Region: 13
Location:                               Home Domain:
Name:

AUDIO PARAMETERS
  Codec Set: 1
  UDP Port Min: 2048
  UDP Port Max: 3028
  Intra-region IP-IP Direct Audio: yes
  Inter-region IP-IP Direct Audio: yes
  IP Audio Hairpinning? y
  RTCP Reporting Enabled? y
  RTCP MONITOR SERVER PARAMETERS
  Use Default Server Parameters? y

DIFFSERV/TOS PARAMETERS
  Call Control PHB Value: 34
  Audio PHB Value: 46

802.1P/Q PARAMETERS
  Call Control 802.1p Priority: 7
  Audio 802.1p Priority: 6
  AUDIO RESOURCE RESERVATION PARAMETERS
  RSVP Enabled? n

H.323 IP ENDPOINTS
  H.323 Link Bounce Recovery? y
  Idle Traffic Interval (sec): 20
  Keep-Alive Interval (sec): 5
  Keep-Alive Count: 5
```

On Page 3 specify the limits between the direct regions controlled by Gatekeeper 1. What is shown here is that 3 calls will be allowed between Region 13 and Region 11; 3 calls between Region 13 and Region 12; 2 calls between Region 13 and Region 14. The limit can also be specified by bandwidth (e.g. 256:Kbits). When using bandwidth, take into consideration the Codec used and the packet size; for example G.711 with 20 ms packets use approximately 83 Kbits/sec. Appendix 1 shows bandwidth guidelines based on codec and frame size used. For a detailed description of bandwidth calculations and setting WAN bandwidth limits between network regions, consult the Administrator’s Guide for Avaya Communication Manager.

```
display ip-network-region 13                                     Page 3 of 19

                                Inter Network Region Connection Management

src dst  codec  direct
rgn rgn   set   WAN    WAN-BW-limits  Intervening-regions  Dynamic CAC
13  1
13  2
13  3
13  4
13  5
13  6
13  7
13  8
13  9
13  10
13  11  1      y      3:Calls
13  12  1      y      3:Calls
13  13  1
13  14  1      y      2:Calls
13  15
```

10. Page 3 of the screens for Regions 11 and 12 show that 3 calls are allowed between Regions 11 and 12. Page 3 of the screens for Regions 11, 12, and 14 show that connectivity between Regions 11 and 14, as well as 12 and 14 was indirect, with intervening region 13. When a connection is indirect, the limits for the intervening region apply, for example if a call is to go from region 11 to 14, the limits to go from 11 to 13 and 13 to 14 will apply.

```
display ip-network-region 11                                     Page 3 of 19
Inter Network Region Connection Management
src dst codec direct Dynamic CAC
rgn rgn set WAN WAN-BW-limits Intervening-regions Gateway
11 1
11 2
11 3
11 4
11 5
11 6
11 7
11 8
11 9
11 10
11 11 1
11 12 1 y 3:Calls
11 13 1 y 3:Calls
11 14 1 n 13: : :
11 15
```

```
display ip-network-region 12                                     Page 3 of 19
Inter Network Region Connection Management
src dst codec direct Dynamic CAC
rgn rgn set WAN WAN-BW-limits Intervening-regions Gateway
12 1
12 2
12 3
12 4
12 5
12 6
12 7
12 8
12 9
12 10
12 11 1 y 3:Calls
12 12 1
12 13 1 y 3:Calls
12 14 1 n 13: : :
12 15
```

```
display ip-network-region 14                                     Page 3 of 19
Inter Network Region Connection Management
src dst codec direct Dynamic CAC
rgn rgn set WAN WAN-BW-limits Intervening-regions Gateway
14 1
14 2
14 3
14 4
14 5
14 6
14 7
14 8
14 9
14 10
14 11 1 n 13: : :
14 12 1 n 13: : :
14 13 1 y 2:Calls
14 14 1
```

11.	Automatic Route Selection was used to route calls to the appropriate locations. This solution would also work with Automatic Alternate Routing and a Uniform Dial Plan. Since these are standard routine configurations, additional detail was not deemed necessary. It is worth re-emphasizing here that in this configuration the end PBXs only had signaling groups, trunk groups, and route patterns to their respective Gatekeepers. In a large configuration this significantly reduces administration required for trunks, signaling groups, and routing at each end PBX. All call routing takes place by the gatekeepers.
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### 3.2. Configuring the Avaya S8500 Server and G650 Gateway serving as Gatekeeper 2

Gatekeeper 2 had 1 C-LAN and 1 MEDPRO, assigned to VLAN 30, and in Network Region 14.

1.	Add Node Names for Gatekeeper 2's C-LAN and MEDPRO cards, and assign them the appropriate IP Address. Add Node Names for the remote C-LANs to which Gatekeeper 2 will have signaling groups.
<pre>change node-names ip</pre>	
IP NODE NAMES	
Name	IP Address
GK1-CLAN1	50 .1 .1 .10
GK2-CLAN1	30 .1 .1 .10
GK2-MEDPRO1	30 .1 .1 .11
PBX3-CLAN1	20 .1 .1 .10
default	0 .0 .0 .0
procr	. . .

<p><b>2.</b></p>	<p>Add an IP Interface for the local C-LAN card, located in slot a02. The “Node Name” must match the one assigned in the Node Names form. Assign the appropriate “Network Region” and “VLAN” (in this case 14 and 30 respectively). Set the “Enable Ethernet Port” field to “y”.</p> <pre> add ip-interface a02                                  IP INTERFACES                                  Type: C-LAN                                 Slot: 01A02                                 Code/Suffix: TN799 D                                 Node Name: GK2-CLAN1                                 IP Address: 30 .1 .1 .10                                 Subnet Mask: 255.255.255.0                                 Gateway Address: 30 .1 .1 .1                                 Enable Ethernet Port? y                                 Network Region: 14                                 VLAN: 30                                  ETHERNET OPTIONS                                 Auto? n                                 Speed: 100Mbps                                 Duplex: Full  Number of CLAN Sockets Before Warning: 400 </pre>
<p><b>3.</b></p>	<p>Add an IP Interface for the local MEDPRO card, located in slot a03. The IP Interface for a MEDPRO is configured in the same way as for a C-LAN.</p> <pre> add ip-interface a03                                  IP INTERFACES                                  Type: MEDPRO                                 Slot: 01A03                                 Code/Suffix: TN2302                                 Node Name: GK2-MEDPRO1                                 IP Address: 30 .1 .1 .11                                 Subnet Mask: 255.255.255.0                                 Gateway Address: 30 .1 .1 .1                                 Enable Ethernet Port? y                                 Network Region: 14                                 VLAN: 30                                  ETHERNET OPTIONS                                 Auto? n                                 Speed: 100Mbps                                 Duplex: Full </pre>

4.	<p>Add a data module for the C-LAN. Select a unique “Data Extension” and “Link” for each data module. Note that the “Name” for the data module does not need to match the “Node Name” associated with the C-LAN. The association is done by the port field, which is a combination of the slot (01A02) and the signaling port (17). Set the “Type” field to “ethernet”.</p> <pre> display data-module 20000                                 DATA MODULE Data Extension: 20000           Name: GK2-CLAN1 Type: ethernet Port: 01A0217 Link: 1  Network uses 1's for Broadcast Addresses? y </pre>
----	--



5. Gatekeeper 2 has a signaling group and trunk group to Gatekeeper 1. There is also a signaling group and trunk group to the Avaya S8700 Server and G600 Gateway that is directly connected to Gatekeeper 2.
- The signaling group and trunk groups are configured in the same manner as shown for Gatekeeper 1. The configuration for the signaling group to Gatekeeper 1 is shown here for comparison. The “Far-end Network Region” for Gatekeeper 1 is 13. The configuration screens for trunk group 617, to Gatekeeper 1, are shown in the next step.

```
display signaling-group 5

SIGNALING GROUP

Group Number: 5          Group Type: h.323
Remote Office? n         Max number of NCA TSC: 0
SBS? n                   Max number of CA TSC: 0
Trunk Group for NCA TSC:
Trunk Group for Channel Selection: 617
Supplementary Service Protocol: b    Network Call Transfer? n

Near-end Node Name: GK2-CLAN1        Far-end Node Name: GK1-CLAN1
Near-end Listen Port: 1719           Far-end Listen Port: 1719
Far-end Network Region: 13

LRQ Required? y          Calls Share IP Signaling Connection? n
RRQ Required? n          H245 Control Addr On FACility? n
Media Encryption? n      Bypass If IP Threshold Exceeded? y

DTMF over IP: in-band    Direct IP-IP Audio Connections? y
                          IP Audio Hairpinning? y
                          Interworking Message: PROGRESS
```

The configuration for the signaling group to the Avaya S8700 Server and G600 Gateway is shown here for comparison. The “Far-end Network Region” for the Avaya S8700 Server and G600 Gateway is 15. The screens for trunk group 619 are not shown, but are very similar to those of trunk group 617, shown in the next step.

```
display signaling-group 1

SIGNALING GROUP

Group Number: 1          Group Type: h.323
Remote Office? n         Max number of NCA TSC: 0
SBS? n                   Max number of CA TSC: 0
Trunk Group for NCA TSC:
Trunk Group for Channel Selection: 619
Supplementary Service Protocol: b    Network Call Transfer? n

Near-end Node Name: GK2-CLAN1        Far-end Node Name: PBX3-CLAN1
Near-end Listen Port: 1719           Far-end Listen Port: 1719
Far-end Network Region: 15

LRQ Required? y          Calls Share IP Signaling Connection? n
RRQ Required? n          H245 Control Addr On FACility? n
Media Encryption? n      Bypass If IP Threshold Exceeded? y

DTMF over IP: in-band    Direct IP-IP Audio Connections? y
                          IP Audio Hairpinning? y
                          Interworking Message: PROGRESS
```

6. These screen shots show how the trunk group on Gatekeeper 2, that connects to Gatekeeper 1, was configured.

```
display trunk-group 617                                     Page 1 of 22

                                TRUNK GROUP

Group Number: 617                      Group Type: isdn          CDR Reports: y
Group Name: IP Trunk to GK1             COR: 1                 TN: 1          TAC: 139
Direction: two-way                     Outgoing Display? n    Carrier Medium: IP
Dial Access? n                         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
TRUNK PARAMETERS
    Codeset to Send Display: 6          Codeset to Send National IEs: 6
    Max Message Size to Send: 260      Charge Advice: none
    Supplementary Service Protocol: b   Digit Handling (in/out): enbloc/enbloc

    Trunk Hunt: cyclical                QSIG Value-Added? n
                                Digital Loss Group: 18
Incoming Calling Number - Delete:      Insert:                Format:
    Bit Rate: 1200                    Synchronization: async Duplex: full
Disconnect Supervision - In? y Out? n
Answer Supervision Timeout: 0
```

```
display trunk-group 617                                     Page 2 of 22
TRUNK FEATURES
    ACA Assignment? n                  Measured: none        Wideband Support? n
                                Internal Alert? n            Maintenance Tests? y
                                Data Restriction? n          NCA-TSC Trunk Member:
                                Send Name: y                 Send Calling Number: y
                                Hop Dgt? n
    Used for DCS? n                    Format: public
    Suppress # Outpulsing? n          Outgoing Channel ID Encoding: preferred
    UUI IE Treatment: service-provider

                                Replace Restricted Numbers? n
                                Replace Unavailable Numbers? n
                                Send Connected Number: y
                                Modify Tandem Calling Number? n

    Send UUI IE? y
    Send UCID? n
    Send Codeset 6/7 LAI IE? y

    Path Replacement with Retention? n
    Path Replacement Method: better-route
    SBS? n Network (Japan) Needs Connect Before Disconnect? n
```

```
display trunk-group 617                                     Page 6 of 22

                                TRUNK GROUP

Administered Members (min/max):      1/10
GROUP MEMBER ASSIGNMENTS              Total Administered Members: 10

    Port      Code Sfx Name      Night      Sig Grp
1: T00005
2: T00006
3: T00007
4: T00008
```

7. Call and Bandwidth limits are configured on page 3 of the IP Network Region form. Gatekeeper 2 is logically associated with Network Region 14. On Page 1 of the IP Network Region, set “Intra-region IP-IP Direct Audio” and “Inter-region IP-IP Direct Audio” to “yes. Set the “IP Audio Hairpinning” field to “y”.

```
change ip-network-region 14                                     Page 1 of 19

                                IP NETWORK REGION
Region: 14
Location:                               Home Domain:
Name:

                                Intra-region IP-IP Direct Audio: yes
                                Inter-region IP-IP Direct Audio: yes
                                IP Audio Hairpinning? y
AUDIO PARAMETERS
Codec Set: 1
UDP Port Min: 2048
UDP Port Max: 3028
                                RTCP Reporting Enabled? y
                                RTCP MONITOR SERVER PARAMETERS
                                Use Default Server Parameters? y
DIFFSERV/TOS PARAMETERS
Call Control PHB Value: 34
Audio PHB Value: 46
802.1P/Q PARAMETERS
Call Control 802.1p Priority: 7
Audio 802.1p Priority: 6
                                AUDIO RESOURCE RESERVATION PARAMETERS
H.323 IP ENDPOINTS
                                RSVP Enabled? n
H.323 Link Bounce Recovery? y
Idle Traffic Interval (sec): 20
Keep-Alive Interval (sec): 5
Keep-Alive Count: 5
```

On Page 3 specify the limits between the direct regions controlled by Gatekeeper 2. What is shown here is that 2 calls will be allowed between Region 14 and Region 13; and 3 calls between Region 14 and Region 15. Specify the limit by bandwidth (e.g. 256:Kbits). When using bandwidth, take into consideration the codec used and the packet size; for example G.711 with 20 ms packets use approximately 83 Kbits/sec. For a detailed description of bandwidth calculations check the Administrator’s Guide for Avaya Communication Manager [1], or Appendix 1.

```
change ip-network-region 14                                     Page 3 of 19

                                Inter Network Region Connection Management

src dst  codec  direct
rgn rgn   set   WAN    WAN-BW-limits  Intervening-regions  Dynamic CAC
                                Gateway
14 1
14 2
14 3
14 4
14 5
14 6
14 7
14 8
14 9
14 10
14 11
14 12
14 13 1      y      2:Calls
14 14 1
14 15 1      y      3:Calls
```

8. Connectivity between Regions 13 and 15 was indirect. The following screens show Page 3 of regions 13, and 15, showing the indirect configuration, and the intervening region being 14. For example if a call is to go from region 13 to 15, the limits to go from 13 to 14 and 14 to 15 will apply.

display ip-network-region 13 Page 3 of 19

Inter Network Region Connection Management

src rgn	dst rgn	codec set	direct WAN	WAN-BW-limits	Intervening-regions	Dynamic CAC Gateway
13	1					
13	2					
13	3					
13	4					
13	5					
13	6					
13	7					
13	8					
13	9					
13	10					
13	11					
13	12					
13	13	1				
13	14	1	y	2:Calls		
13	15	1	n		14:	: :

display ip-network-region 15 Page 3 of 19

Inter Network Region Connection Management

src rgn	dst rgn	codec set	direct WAN	WAN-BW-limits	Intervening-regions	Dynamic CAC Gateway
15	1					
15	2					
15	3					
15	4					
15	5					
15	6					
15	7					
15	8					
15	9					
15	10					
15	11					
15	12					
15	13	1	n		14:	: :
15	14	1	y	3:Calls		
15	15	1				

9. Automatic Route Selection was used to route calls to the appropriate locations. This solution would also work with Automatic Alternate Routing and a Uniform Dial Plan. Since these are standard routine configurations, additional detail was not deemed necessary. It is worth re-emphasizing here that in this configuration the end PBXs only had signaling groups, trunk groups, and route patterns to their respective Gatekeepers. In a large configuration this significantly reduces administration required for trunks, signaling groups, and routing at each end PBX. All call routing takes place by the gatekeepers.

### **3.3. Configuring the Avaya DEFINITY® Server R, S8700 Servers, MCC1 Media Gateways, and G600 Media Gateway acting as PBX Nodes**

Configuration of the PBX nodes involves similar steps to configuring the Gatekeepers, with the exception of the Call Admission Control (CAC) entries in the network regions. Connection management and CAC limitations are only done at the Gatekeepers, therefore the third page of the network regions is left empty on the PBX nodes.

Follow steps 1 through 4 of the previous sections to administer the Node Names, IP interfaces, and Data Channels. Note that in early software versions the “Change IP-Interface” command was used to bring up a form that allowed the input of multiple IP Interfaces at the same time. In later software versions, each IP Interface was configured separately as shown in section 3.1, steps 2 and 3.

On Avaya G3R Server 1 the following trunk and signaling groups must be configured to match the configuration on Gatekeeper 1:

- Trunk Group 614 and its corresponding signaling group
- Trunk Group 615 and its corresponding signaling group

On Avaya G3R Server 2 the following trunk and signaling groups must be configured to match the configuration on Gatekeeper 1:

- Trunk Group 614 and its corresponding signaling group

On the Avaya S8700 Server the following trunk and signaling groups must be configured to match the configuration on Gatekeeper 2:

- Trunk Group 619 and its corresponding signaling group

The following steps show the configuration screens for the IP Interfaces, trunk groups and signaling groups on the Avaya S8700 server. The configurations on the Avaya DEFINITY® Server R is done in a similar manner. Also note that there may be minor screen changes between Avaya Communication Manager software versions. The screens shown here correspond to Software Version 1.3.

- The older version of the IP Interfaces form is shown here. The “ON” field should be set to “y” to enable the IP Interface. The “Type” field is the interface type, “C-LAN” or “MEDPRO”. The “Slot” field is the card location. The “Code” and “Sfx” fields are automatically populated when the “Slot” is entered. The “Node Name” is the name association for the interface in the “IP Node Names” table (see sample screen in Section 3.1, step 1). The “Subnet Mask” and “Gateway Address” are the respective mask and gateway for the IP Interface. The “Net Rgn” is the network region associated with the IP Interface, in this case 15. The “VLAN” is the VLAN associated with the IP Interface, in this case 20.

change ip-interfaces Page 1 of 19

IP INTERFACES										
ON	Type	Slot	Code	Sfx	Node Name	Subnet Mask	Gateway	Address	Net Rgn	VLAN
y	C-LAN	01A04	TN799	D	SGINT-CLAN1	255.255.255.0	20 .1	.1 .1	15	20
y	MEDPRO	01A05	TN2302		SGINT-MEDPRO1	255.255.255.0	20 .1	.1 .1	15	20
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n
n						255.255.255.0	.	.	.	n

2. There is one signaling group between the Avaya S8700 Server and Gatekeeper 2. When adding a signaling group, the “Trunk Group for Channel Selection” field must be left blank until the trunk group is configured. After the trunk group is configured use the “change signaling-group 1” command to populate the trunk group number. The “Supplementary Service Protocol” field was set to “b” to use QSIG signaling. The “Near-end Node Name” field should be set to the node name of a local C-LAN. The “Far-end Node Name” field should be set to the node name of a remote C-LAN. The “Near-End Listen Port” and “Far End Listen Port” should be “1719”. The “Far-End Network Region” associated with Gatekeeper 2 is “14”. “LRQ Required” should be set to “y”. “Direct IP-IP Audio Connections” and “IP Audio Hairpinning” should be set to “y”.

```
display signaling-group 1
```

SIGNALING GROUP

Group Number: 1

Group Type: h.323

Remote Office? n

Max number of NCA TSC: 0

SBS? n

Max number of CA TSC: 0

Trunk Group for NCA TSC:

Trunk Group for Channel Selection: 619

Supplementary Service Protocol: b

Near-end Node Name: SGINT-CLAN1

Far-end Node Name: GK2-CLAN1

Near-end Listen Port: 1719

Far-end Listen Port: 1719

Far-end Network Region: 14

LRQ Required? y

Calls Share IP Signaling Connection? n

RRQ Required? n

H245 Control Addr On FACility? n

Bypass If IP Threshold Exceeded? y

DTMF over IP: in-band

Direct IP-IP Audio Connections? y

IP Audio Hairpinning? y

Interworking Message: PROGRESS

3. These screen shots show how the trunk group on the Avaya S8700 Server that connects to Gatekeeper 2 was configured.

```
display trunk-group 619                                     Page 1 of 22

                                TRUNK GROUP

Group Number: 619                      Group Type: isdn          CDR Reports: y
  Group Name: IP Trunk to GK2          COR: 1              TN: 1          TAC: 141
  Direction: two-way                  Outgoing Display? n    Carrier Medium: IP
  Dial Access? n                      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
TRUNK PARAMETERS
  Codeset to Send Display: 6          Codeset to Send National IEs: 6
  Max Message Size to Send: 260      Charge Advice: none
  Supplementary Service Protocol: b   Digit Handling (in/out): enbloc/enbloc

  Trunk Hunt: cyclical                QSIG Value-Added? n
                                Digital Loss Group: 18
Calling Number - Delete:              Insert:                Numbering Format:
  Bit Rate: 1200                    Synchronization: async Duplex: full
Disconnect Supervision - In? y Out? n
Answer Supervision Timeout: 0
```

```
display trunk-group 619                                     Page 2 of 22
TRUNK FEATURES
  ACA Assignment? n                  Measured: none        Wideband Support? n
                                Internal Alert? n        Maintenance Tests? y
                                Data Restriction? n      NCA-TSC Trunk Member:
                                Send Name: y          Send Calling Number: y
  Used for DCS? n                    Hop Dgt? n
  Suppress # Outpulsing? n          Numbering Format: public
Outgoing Channel ID Encoding: preferred  UII IE Treatment: service-provider

                                Replace Restricted Numbers? n
                                Replace Unavailable Numbers? n
                                Send Connected Number: y

  Send UII IE? y
  Send UCID? n
Send Codeset 6/7 LAI IE? y

Path Replacement with Retention? n
Path Replacement Method: better-route
                                SBS? n Network (Japan) Needs Connect Before Disconnect? n
```

```
display trunk-group 619                                     Page 6 of 22

                                TRUNK GROUP
                                Administered Members (min/max): 1/10
GROUP MEMBER ASSIGNMENTS          Total Administered Members: 10

  Port    Code Sfx Name      Night      Sig Grp
1: T00001
2: T00002
3: T00003
4: T00004
```



4. This screen shot shows the route pattern used for routing calls between UK1 and US1. Trunk group 619 is the first preference and trunk group 620 is the second preference. “LAR” is enabled on the route pattern, and set to “next”. This allows calls to re-route over the second trunk group if the first one is unavailable or calls over the first trunk group are rejected.

```
display route-pattern 1                                     Page 1 of 3
Pattern Number: 1 Pattern Name: In-Country Ext

Grp FRL NPA Pfx Hop Toll No. Inserted DCS/ IXC
No      Mrk Lmt List Del Digits  QSIG
                                Intw
1: 619 0 1 n user
2: 620 0 1 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 Request Dgts Format Subaddress
1: y y y y y n n both ept next
2: y y y y y n n both ept 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
```

## 4. Verification Steps

To verify if the trunks are up and working, use the “Status Trunk” command in Avaya Communication Manager. For example, “status trunk 617”. For trunk ports with active calls the status should be “in-service/active”. For idle trunk ports the status should be “in-service/idle”.

To verify calls are routing properly over the appropriate trunks, use the Avaya Communication Manager “Status Trunk” command, or the “Monitor Trunk” command.

To verify calls are using the appropriate codecs, use the Avaya Communication Manager “status station” command, when the station is active on a call.

To verify that the Gatekeepers are properly managing the limits specified for the network regions, place calls between the regions, and when the limits are reached, the call should re-route over an alternate path if LAR is configured, or fast busy should be heard if no alternate path is available.

## 5. Conclusion

As illustrated by these Application Notes, Avaya Communication Manager can be used in a Centralized Gatekeeper environment to minimize the administrative complexity for enterprises deploying a large and growing number of IP-enabled PBXs and call servers.

## Appendix 1

The following table can be used to help assess how much bandwidth (in Kbits/sec) is used for various types of codecs and packet sizes. The values in this table assume a 7 byte L2 WAN header and are rounded up.

Packet Size	10 ms	20 ms	30 ms	40 ms	50 ms	60 ms
G.711	102	83	77	74	72	71
G.729	46	27	21	18	16	15
G.723-6.3	NA	NA	19	NA	NA	13
G.723-5.3	NA	NA	18	NA	NA	12

The values shown here were derived from the Administrator's Guide for Avaya Communication Manager, Issue 8, June 2004. Refer to the Administrator's Guide for additional detail on these calculations.

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