Avaya Distributed Office Call Routing and Digit Manipulation

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Product: Avaya Distributed Office

This document describes Distributed Office flexible call routing algorithms and digit manipulation capabilities.

1. General

1.1. *Table of Contents*

1.2. *Terminology, Abbreviations and Acronyms*

AAR	Automatic Alternate Routing (Routing tables for outgoing "on-net" calls)
ACB	Automatic call-back
ANI	Automatic number identification
ARS	Automatic Route Selection (routing table for outgoing "off-net" calls)
Bridged appearance	A button on a user's telephone that represent a call appearance of an other user
Call appearance	A button on a telephone that allows the users to initiate internal or external calls using the PBX user environment.
CAMA	Centralized Automatic Message Accounting - An analog trunking technology used in North America which can deliver the calling party number. CAMA is important to allow a Service Provider deliver emergency calls to the right Public Safety Answering Point (PSAP)
CM	Communication Manager
CSV	Comma-separated values (a text file format that can represent tables, which is readable by spreadsheets applications such as Microsoft Excel).
DAC	Dial Access Code - the Distributed Office dial plan term that covers TAC and .AC)
DO	Distributed Office

DOCM	Distributed Office Central Manager (Network Management application)
DOLM	Distributed Office Local Manager (Distributed Office's element management web pages)
EC500	Extension to Cellular feature of Distributed Office
FAC	Feature access code
FNE	Feature Name Extension. A virtual extension that, when called, from an EC500 cell telephone, invokes a Distributed Office feature
ICHT	Incoming call-handling treatment also known as incoming call number manipulation.
ITSP	Internet telephony service providers.
LAR	Look-ahead routing
Line appearance	A button on a telephone that represent a specific OLG (key system button).
NMC	Network Management Console (a Network management suite, which includes Distributed Office Central Manager, SUM, FaultMon and other applications)
Off-net	Routing to an external network for example, to the PSTN)
OLG	Outside line group (a group containing a "key system" line and extensions)
On-net	Routing over a private network (in our case, the private SIP trunk to the SES edge)
PDD	Post-dial delay
PPM	Personal Profile Manager. A Distributed Office web-service used by Avaya SIP telephones for configuration.
PSAP	PSAP is an acronym for Public Safety Answering Point, an agency in the United States, typically county or city controlled, responsible for answering 9-1-1 calls for emergency assistance from police, fire, and ambulance services.
PSTN	The Public switched telephone network
PUN	Public Unknown Numbering

SES edge	Avaya SIP Enablement Server. The SES has two roles, a "Home" which connects to Communication Manager and IP telephones and an "Edge" which connects to other "homes" to Distributed Office system and, possibly, to ITSPs.
TAC	Trunk access code

1.3. *Overview*

A typical Distributed Office branch system has multiple connections to many resources:

- H.323, SIP, or analog endpoints.

- Connectivity to Service Providers and the PSTN via trunking technologies such as SIP, DS1/ISDN or analog.

- A private network connection to the enterprise core and to other branches via the SES edge.

- Internal resources, such as hunt groups, voice mail or auto-attendant that are available to the users.

The call routing scenarios can be divided to five categories:

1) Calling an extension or resource, such as local voice mail, within the branch. In this case, the user directly dials the resource extension number.

2) On-net calling to an extension outside the branch. Here, the user wishes to call a remote extension over the private network via the SES edge. The user has to dial the AAR feature access code followed by a private network dial string.

3) Off-net calling to the PSTN via one of the local trunks. In this case, the user has to dial the ARS FAC or uses a line-appearance button followed by a PSTN number

4) Incoming on-net calls coming over the private SIP trunk from the SES edge: Distributed Office's incoming routing algorithm assures that all its local extensions and resources are accessible via the private trunks.

5) Incoming off-net calls coming from one of the local trunks. Distributed Office's routing algorithm allows the administrator to map incoming calls to the right extension or resource.
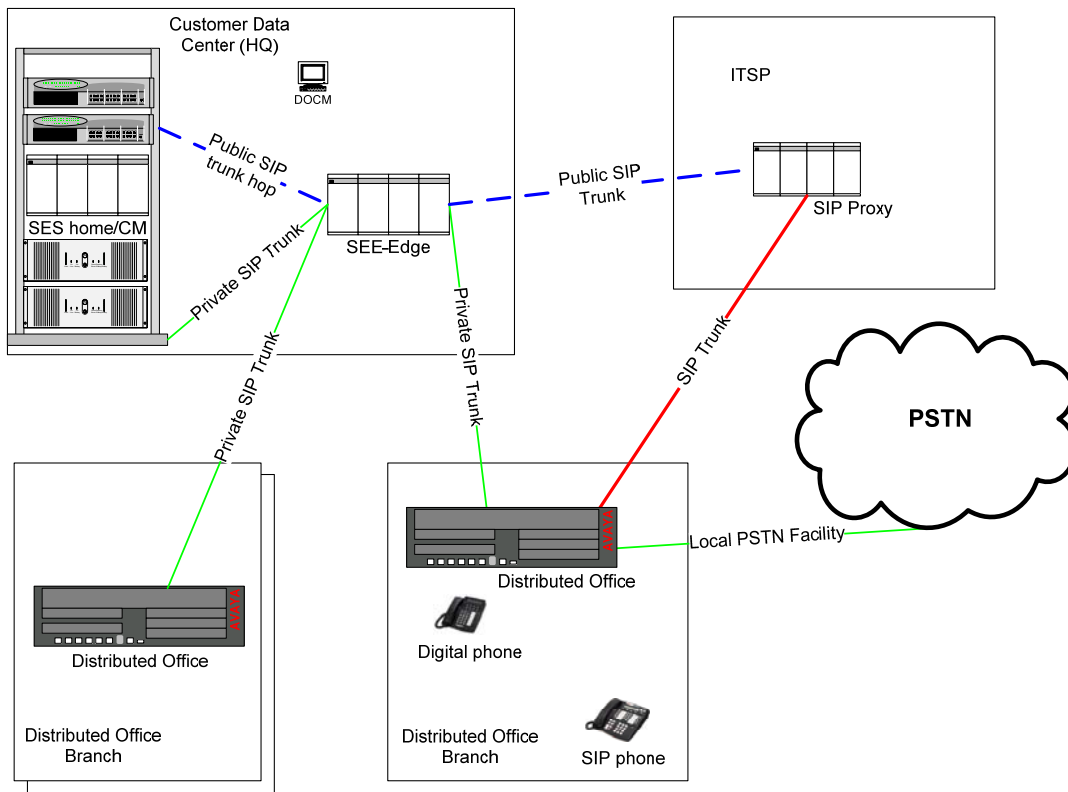
Figure 1 - A Distributed Office Network

2. Outgoing calls

Distributed Office offers two user environments for outgoing calls: regular, PBX-like user environment and key system user environment. You can combine both environments in a single system, or even within a single terminal.

2.1. *PBX user environment*

The PBX user environment has the most flexibility; however, users need to follow basic dialing rules, for example "dial 9" for an outside line. Calls from Distributed Office systems are initiated when a user starts to dial a number or presses a "call appearance" button. There is a major difference between SIP telephones and other types of telephones at this stage. Analog, digital and H.323 telephones sends the dial digits one-by-one to Distributed Office - this method is called "overlapped dialing". SIP telephones collect the digits dialed by the user and send them to the Distributed Office system when the user is done, this is known as "enbloc dialing".

SIP telephones use three different mechanisms for digit collection (detecting the end of the dial string):

1) Dial Plan: SIP telephones have an internal dial plan which determines the length of the dialed string based on the string's prefix. The dial plan can provide either an exact length or range of lengths according to the prefix. In the latter case, the telephone uses inter-digit timer (see below). Avaya SIP telephones receive the dial plan from Distributed Office's PPM process. Distributed Office's PPM generates the dial-plan automatically, based on the Distributed Office configuration.

2) Inter-digit timer: In some cases, especially when calling outside numbers, the dial-plan does not - or cannot - hold the exact dial string length for each prefix. A good example is when calling to international numbers, as each country can have different dial-string length for each of its area codes. To deal with this problem, SIP telephones have configurable inter-digit timers. SIP telephones reset the inter-digit timer every time the user enters a new digit. SIP telephones assume that the user has finished dialing when the inter-digit timer expires, regardless of the dial plan.

3) "#" or 'send' button: When the user presses "#" to mark the end of the dial string end, the SIP telephone sends the dial string to Distributed Office immediately (without waiting for the inter-digit timer to expire). This also works with Distributed Office analog, digital & H.323 telephones.

Distributed Office performs the same digit collection process for analog, digital and H.323 telephones, while the routing itself is the same regardless of the terminal type.

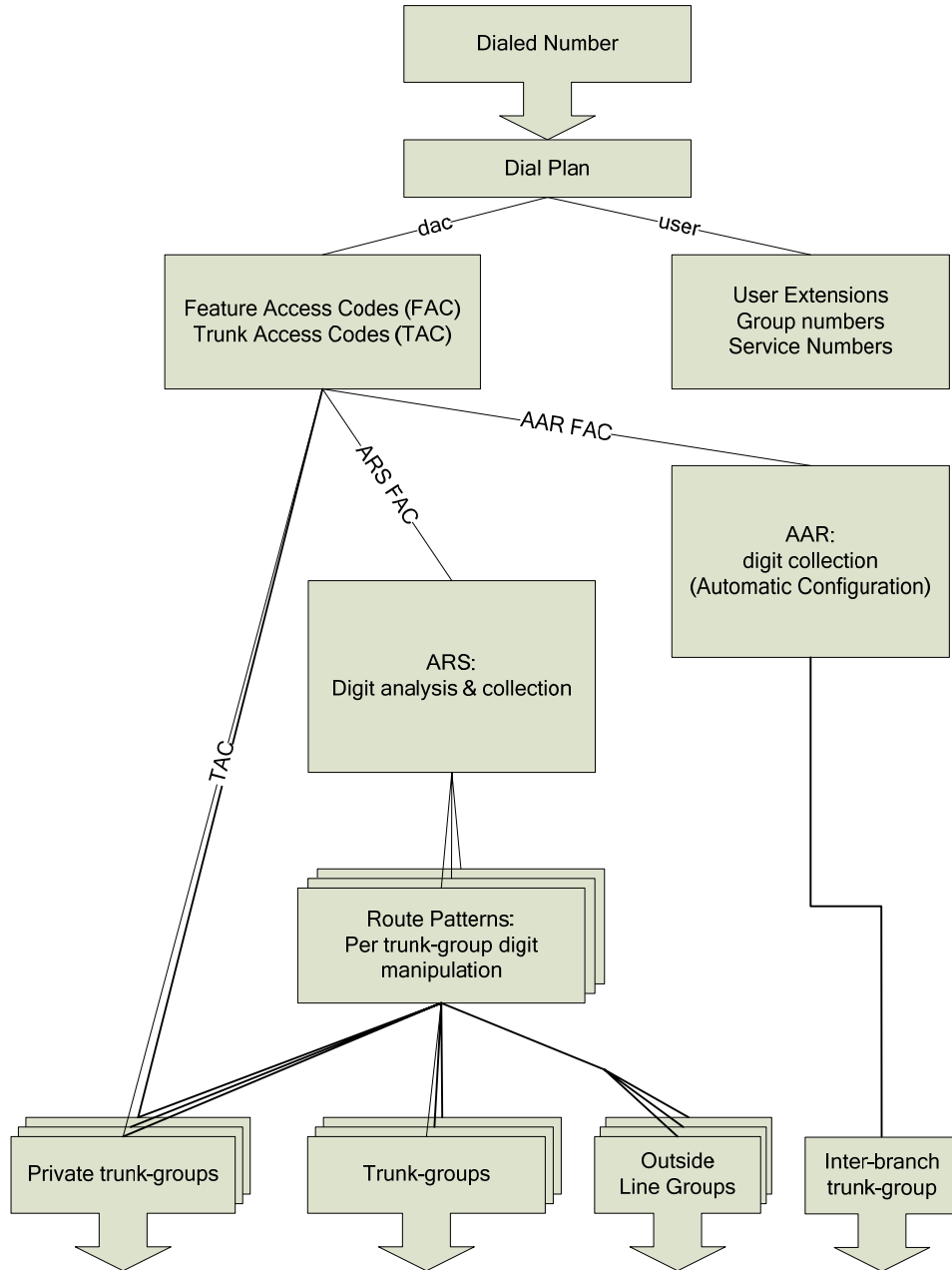Figure 2 describes the tables and methods involved in regular call routing.

Figure 2 - Normal Call routing

2.1.1. Dial Plan:

The dial-plan is the entry point for normal dialing. The Distributed Office dial plan classifies dial strings as DAC or User, based on the first digit. In Distributed Office, all the user extensions lengths are the same. The extension length is also specified in the dial-plan page.

- User: anything that has an extension number. This type includes regular user extension numbers, groups (hunt groups, paging groups, collective ringing groups etc) and service numbers (voice mail number, feature name extension etc).

- DAC: This type includes Feature Access codes, for example, ARS, contact-closure open, and so on, and TACs (trunk access codes).

2.1.2. Automatic Alternate Routing (AAR) table

The Automatic Alternate Routing table is responsible for digit collection for calls over the private network, known as on-net calls. The private network is composed of a SIP trunk to the core SES edge. The SES edge is a SIP proxy with connections to other branches, as well as to SES-Home/CM (if present).The administrator cannot edit this table in Distributed Office. Distributed Office Central Manager automatically fills the AAR table based on configured branch prefixes.

In Distributed Office; the AAR table is only responsible for digit collection as there is only one private network trunk available, the interbranch trunk to the SES Edge Core Router[1]. Consequently, Distributed Office Central Manager can use a compression algorithm to reduce the number of prefixes it has to send to the branches. For example, if there are four branch prefixes 10,11,12, and 13 all with the same four-digit extension length, Distributed Office Central Manager would generate AAR table with a single row: prefix=1, min=6, max=6.

2.1.3. Automatic Route Selection (ARS) and Route Patterns

The ARS table and the route patterns referred by it are responsible for digit collection, digit manipulation, route selection and access control for off-net calls. End users access the ARS table by dialing the ARS FAC (usually "9") and the system responds with a dial-tone. From this stage on, the Distributed Office collects the dialed digits and matches them to the ARS configuration. SIP telephones perform their own digit collection and send the complete dial string to Distributed Office for ARS processing.

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[1] "Core Router" is the Avaya term for SIP routing according to branch prefixes received from Distributed Office Central Manager. Currently, Core-Router functionality is available in SES servers that are in Edge mode but not in SES servers in combination home-edge mode (or home mode).

In the ARS table "dialed string", "min" & "max" are used to match the dial strings while "route-pattern", "call type", "toll" & "allow for all" columns specify the treatment for a matched call. The ARS table implements a "longest match" algorithm. So if there are two applicable rows, one containing "123" in the "dialed string" field and the other containing "1234", and the user dials 12345, the latter would match.

The min and max parameters specify the minimum and maximum dial-string length associated with the specified dial string. Usually, the exact dial-string length is already known for some or all prefixes. For example, in North America the length for all dial-strings which start with 1 is 11 digits. Hence, "min" can be equal to "max". In other cases, for example international calls, the dial-string length can vary and, as such, "min" will not be equal "max" and the system digit collection mechanism will have to utilize "inter-digit timers" in order to determine that the user has finished dialing. As mentioned earlier, the user can mark the dial-string end with a "#", which can shorten post dial-delays.

Route Patterns contain ordered lists of outgoing trunk groups, as well as corresponding digit manipulation rules. Route patterns, as well as other digit manipulation rules, work on the beginning of the dial string. They involve two actions. First, the system deletes (or absorbs) the specified number of digits from the beginning of the dial-string. Second, the system adds the configured digit string to start of the dial-string. For example:

Table 1 - sample digit manipulations

Original Dial String	Delete	Insert	Result
036457561	1	"+972"	+97236457561
01197236457561	3	""	97236457561
6457561	3	"3"	37561

The ARS table selects a route pattern based on the dial string. This route pattern contains a prioritized list of trunk groups and Distributed Office tries the trunk according to this list. Trunk groups that are down or busyout are ignored. Distributed Office has Look-Ahead Routing capabilities (LAR) so upon an error, such as SIP server timeout, it can try to place the call over the next trunk group. LAR is a building block for Distributed Office's PSTN failover for public SIP trunks.

In addition to trunk-groups, it is possible to specify "outside line groups" in the route-pattern's route selection table. When this option is selected, Distributed Office can send the call over one of the administered outside line groups. Whenever possible, Distributed Office gives preference to an OLG that the calling user owns or is a member of.

The combination of pattern matching by the ARS and the digit manipulation in the route patterns that the ARS refers can be configured to achieve the desired behavior for each off-net dial string.

In addition to route-pattern selection, the ARS table also classifies calls. The options are:

1) Deny: prevent users from using specific dial-strings, thus blocking specific services.. The system plays denial tone or announcement upon match.

2) Emergency – Mark the call as an emergency call.

3) Crisis alert- Mark the call as an emergency and generate an alert to specified internal users.

4) Local – public network local number.

5) Public – public network number (can be international).

These classifications are used in access restrictions. For information about access restrictions, see section 4.

2.1.4. The "auto" route pattern

Distributed Office contains a pre-defined route pattern specially designed for easy connection to the PSTN. Trunk-groups are automatically added to the "auto" trunk group in the order of their creation. For example, if you create an ISDN-PRI trunk-group and then a CO trunk-group, this will be the trunk-group order in the auto-trunk group. OLGs are included in the "auto" route patterns as lowest priority; "private" trunk-groups are not included. The "auto" route pattern does not include the public SIP trunk group because the dial plan of an ITSP is usually not the same as the dial plan used by the local service provider. Hence, some digit manipulation rules are usually needed for public SIP trunks.

For emergency calls, the "auto" trunk-group includes the trunk-groups in a different order with CAMA first, followed by ISDN-PRI, ISDN-BRI, DIOD, CO, TIE, PCOLs and Private trunk-groups last.

You can configure identical behavior by manually defining trunk-groups; however, the "auto" trunk-group can simplify that process.

The "auto" route-pattern does not include trunk-groups with direction="incoming".

2.1.5. ARS configuration example

It might be easier to understand the relationship between ARS, route-patterns and outgoing trunk group selection by following an example. Consider a branch with the following dialing rules ("9" is the ARS FAC)

Table 2 - ARS/Route-patterns example

Type	User dials:	Preferred Route	Route Pattern
Local 7 digit dialing	9 [2-9]xx xxxx	1) Local PRI trunk 2) Public SIP trunk (insert 1 732) 3) Local Analog trunk group	A
Long Distance	9 1 xxx xxx xxxx	1) Public SIP trunk 2) Local PRI trunk 3) Local analog trunk group	B
International	9 011 <4 to 11 digits>	1) Public SIP trunk (delete 3)	C
Local Directory	9 411	1) Local PRI trunk 2) Local analog trunk group	Auto
Emergency	9 911	1) Local PRI trunk 2) Local analog trunk group	Auto
Emergency	9 11	1) Local PRI trunk 2) Local analog trunk group	Auto

Note: There is no US area code which starts with 1 and selection of 9 as the ARS FAC allows us to configure the system so that "911" will be routed to the PSTN.

In this example, the customer would like to route long-distance and international calls via a discount SIP provider. However, if the SIP provider does not respond or if the SIP provider temporarily cannot route the call, the customer would like to route the call via the local PRI or analog trunk-group.

The ARS for the above example would appear as follows:

Dialed string	Min	Max	Route Pattern
2	7	7	A
3	7	7	A
4	7	7	A
5	7	7	A
6	7	7	A
7	7	7	A

Dialed string	Min	Max	Route Pattern
8	7	7	A
9	7	7	A
1	11	11	B
011	7	13	C
411	3	3	Auto
911	3	3	Auto
11	2	2	Auto

Note: The longest prefix match rule assures that 911 is matched by the "911" rule and not by the rule for "9"

Route Pattern A:

Order	Delete	Insert	Trunk group
1	0	""	PRI (2)
2	0	"1732"	public SIP trunk (31)
3	0	""	analog (3)

Note: Distributed Office always uses LAR when multiple trunk-groups are listed in the selected route pattern. In this case, if the PRI is down, Distributed Office will try to send the call over the public SIP trunk to the Internet Telephony Service Provider. The ITSP expects the dial string to be in a 11-digit format. This route pattern is selected by an ARS row for local 7-digit dialing; hence, Distributed Office has to append "1732" to the dial string before sending it to the ITSP. If the ITSP can't route a call, and sends back an error, Distributed Office will try to route the call via the analog trunk-group (#3). The same would happen if the ITSP servers do not respond within the configurable SIP trunk-group parameter "timeout"

Route Pattern B:

This Route Pattern is used for routing long-distance calls.

Order	Delete	Insert	Trunk group
1	0	""	public SIP trunk (31)
2	0	""	PRI (2)
3	0	""	analog (3)

Route Pattern C:

This Route Pattern is used to route international calls.

Order	Delete	Insert	Trunk group
1	3	""	public SIP trunk (31)
2	0	""	PRI (2)
3	0	""	analog (3)

2.1.6. ARS configuration aids

As seen before, an accurate ARS table is essential for dialing outside numbers and an ARS table with strict rules is important in order to avoid the need for "inter-digit timers" and consequent delays. Distributed Office offers a few ways to automate or accelerate ARS configuration:

- "Install from profile": It is possible to include the ARS as part of the installation profile. Avaya offers several installation profiles for vertical markets, for example, the US "chain store" profile, which includes an ARS table for North America. Customers can generate their own profiles, modify Avaya's profiles or order new custom profiles from Avaya.

- Distributed Office Central Manager ARS template: Distributed Office Central Manager supports the configuration of ARS via a template. The Distributed Office Central Manager ARS template covers ARS but not the route patterns. Route-patterns and the ARS table work together to perform the desired trunk group selection and digit manipulation rules. The Distributed Office Central Manager ARS template uses the route-patterns symbolic names as pointers. In order to use a template on a given Distributed Office system, that system must contain route patterns names as referenced in the ARS template. An ARS template that uses the "auto" route pattern only is valid on any Distributed Office system.

- Distributed Office Local Manager/Distributed Office Central Manager import/export capabilities: Distributed Office Central and Local Managers allow the technician to export and import the ARS table to/from a CSV (comma separated values) format text file. Technicians can then edit the file using a spreadsheet like Microsoft Excel and re-import it into the Distributed Office system.

2.1.7. Trunk Access Codes (TAC) and private trunk-groups

Another way to dial out is to use TAC. When dialing a TAC, Distributed Office immediately connects the dialing user to the trunk group - the trunk group is responsible for trunk member selection. From this point on, every digit dialed by the user is sent to

the service provider over the trunk. Hence, this method is only applicable to trunk groups that use overlap dialing.

In Distributed Office, TAC dialing is available only for CO trunk groups marked as 'private' in the "General" tab. As mentioned before, 'private' trunk-groups are not included in the 'auto' route pattern. Hence, private trunk-groups are available only for users that know the TAC or for users that have a button administered on their telephone for this task. The latter can be done with the 'Abbreviated Dialing System List'.

Users with 'low' and higher privilege levels, can use private trunks without restrictions, while, 'none' privilege level users can only dial prefixes that are marked as 'allow for all' in the ARS table.

2.2. *Key System user environment (OLG)*

Distributed Office's key system feature was designed to mimic the user environment of older systems like PARTNER® Advanced Communications System (ACS) Key System telephones have a button/LED combo for some of the system trunks. A user who wishes to place a call must first select an outgoing trunk by pressing one of the buttons. The user can tell which trunks are available by examining the LED status. When a user presses a button of an idle trunk, the system goes "off-hooks" the trunk and connects the user talk-path to it. If the trunk is working, the user hears a dial tone. Next, the user dials digits which are passed one-by-one directly to the service providers. Classic Key systems are simpler than PBXs because digit collection is done by the service provider and not by the key system; thus, there is no ARS to configure. Since key systems do not have digit collection mechanisms, they can work only with trunks that use overlapped dialing (like analog or CO trunks).

In Distributed Office, the same user can have key system and PBX user environments simply by having both PBX line appearances and key system buttons on the terminal. It is important to acknowledge that Distributed Office is not a key system but a PBX that can provide a key system user environment. Consequently, Distributed Office can apply access restrictions for specific PSTN numbers; for example, prevent the waiting area telephone from dialing long-distance numbers. However, configuring Distributed Office is more complex as you must configure the ARS table even if all you want is just a key system user environment.

Currently, key system features are supported only on Avaya 16xx telephones with H.323 firmware.

In Distributed Office Local Manager, key system "lines" are called "Outside Line Groups" (OLG).

OLG is a single key-system "line" and is associated with a single CO trunk. Once an Outside Line Group is created, it is possible to add it as a button ("line appearance") to telephones that support it. The OLG configuration page shows the list of extensions that have a button for the specific OLG.

When a user presses a button of an idle OLG, Distributed Office seizes the OLG trunk. However, unlike a classic key system, the Distributed Office ARS table analyzes the digits dialed by the user and transfer them to the PSTN. The ARS table continues to collect the dialed digit until there is a match – hence, Distributed Office can classify calls and even deny calls to specific numbers. The route patterns pointed by the ARS table are ignored because the outgoing trunk is pre-defined for each OLG.

Note: Avaya Communication Manager has a similar feature called Personalized CO Line (PCOL).

Configuring Distributed Office as a key-system is harder than configuring a classic key-system since, as we saw in section 2.1.3, configuring an ARS table is a complex task. Distributed Office has some powerful ARS configuration aids, described in section 2.1.6
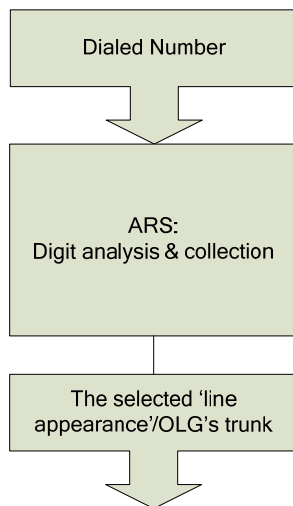

Figure 3 Call routing for Outside Line Groups

3. Incoming call routing

3.1. *ISDN and public SIP trunk groups*

Routing of calls coming from ISDN-PRI, ISDN-BRI or public SIP trunk groups is controlled by the Incoming Call Number Manipulation table, also known as Incoming Call Handling Treatment or ICHT. The ICHT table contains per-trunk group digit manipulation rules that convert the number received from the trunk group, referred to here as the DID number, to the Distributed Office local dial-plan. Thus, it can map incoming calls to local extensions, service numbers, and so on.

The following ICHT columns define the number matching rules:

- Trunk group: Every row is applicable to a single trunk group

- Incoming Called Number: A number prefix to match with the incoming DID number. Distributed Office uses the "longest prefix match" algorithm.

- Incoming Called Number Length: The expected DID number length which is especially important for overlapped dialing.

The following ICHT columns define the action to take if the row matches:

- Delete Digits / Insert Digits: Digit manipulation rules

- Extension: Instead of the delete/insert rules, it is possible to specify an extension number (similar to delete all, insert the extension number)

- Per-call CPN/BN: This field appears only for ISDN trunk groups. Specifies when and how to request Calling Party Number (CPN) or Billing Number (BN) for calls of this type. Leave blank when connected to another media server or switch, or when connected to a public network outside North America. Within North America, leave blank when connected to a public network that does not permit customer equipment to request CPN or BN for individual incoming calls. The AT&T Switched Network offers this service under the titles "CPN/BN to Terminating End on a Per-Call Basis" and "ANI (BN) on Request." An entry of none indicates that Distributed Office will not request either CPN or BN for any incoming calls of this type. Valid entries are cpn-only, bn-only, bn-pref (prefer BN, but accepts CPN), cpn-pref (prefer CPN, but accepts BN), none, or leave blank. Leave blank when connected to another server/switch or to a network other than the AT&T Switched Network.
    - Note: A 4-second delay occurs in terminating the call to the far-end station if the connecting server or switch does not respond to the request.

Note: The ICHT table works for all ISDN trunks, both enbloc & overlapped, in Distributed Office.

Note: ICHT table mapping to DAC is beyond the scope of this document.

3.1.1. ICHT configuration example

Consider a branch with the following extensions:

Table 3 - ICHT configuration example

DID number	Extension Number	Type	Block
8522871	3301	User	
8522872	3302	User	
8522875	3305	User	
8522876	3306	User	
8522882	3382	User	
8522883	3383	User	
8522893	3393	User	
8522888	4001	Auto Attendant #1	

Analyzing the above table shows that this can be "compressed" to the following blocks:

- 8522888 > 4001
- 852287x > 330x
- 85228xx > 33xx

The overlap between the first and 2nd rule suggests that, if the Service Provider sends the number 8522803, it will also map to station 3303. However, the customer already knows which numbers are going to be directed to the trunk group by the service provider. Distributed Office's longest-prefix-match algorithm assures that the first rule has precedence over the second rule and that the second rule has precedence over the third rule.

The resulting ICHT table is:

Trunk group	Incoming Called Number	Incoming Called number Length	Delete Digits	Insert Digits	Extension
PRI	8522888	7			4001
PRI	852287	7	6	330	
PRI	85228	7	5	33	
SIP	17328522888	11			4001
SIP	1732852287	11	10	330	
SIP	173285228	11	9	33	

3.2. *DID and digital DID trunk groups*

DID trunks use an inbound routing mechanism that is simpler than ICHT. You administer incoming call manipulation for these trunk groups on the trunk group's "trunk" parameters tab, which includes the following fields:

- Digit treatment: A drop-down list that specifies the incoming digit manipulation rule type:
    - None. This option assumes that the Service Provider is sending in the extension number. Hence, no digit manipulation rules are needed.
    - Insertion: Insertion assumes that the Service Provider is sending fewer digits than the extension length. In this case, the "digits" field will include the digit-string to append. In theory, it is also possible to append # and * in order to map to FAC or TAC. However, this is out of scope for this document.
    - Absorption: This option assumes that the service provider is sending a number that is longer than Distributed Office extensions. In this case, the "digits" field will specify the number of digits to delete in order to convert the received DID number to extension number
- Digits: works together with "digit-treatment", see above
- Expected Digits: This field contains the number of digits that Service Provider sends for an incoming connection. If the Distributed Office absorbs digits on this trunk group, the value in this field must be larger than the value in the Digits field.
    - Set this field to blank if the Digit Treatment field is set to "insert" and the Digits field contains a feature access code (for example, ARS) followed by digits. In this case, the overall number of digits expected by the system is according to the FAC, for example, the ARS Digit Analysis Table and AAR and ARS Digit Conversion Table.

This method is less powerful than ICHT as it only supports a single rule, whereas ICHT supports multiple prefix rules for a given trunk group.

3.3. *CO trunk groups*

CO trunk groups just "rings"; a service provider connected via a CO trunk cannot send in a called number. Hence, the only configuration available is to send all calls from a CO trunk to a selected extension. The extension is configured in the "Incoming Destination" field in the "General" tab of the CO trunk group page.

3.4. *Interbranch SIP trunk*

As mentioned earlier, the interbranch trunk group is configured by Distributed Office Central Manager. Basically, Distributed Office Central Manager is used to associate each branch with a "branch prefix". All prefixes are the same length in Distributed Office. The numbering scheme over the interbranch trunk is the branch prefix concatenated with the extension number. Distributed Office simply strips the branch prefix from calls coming from the interbranch SIP trunk.

3.5. *Outside Line Groups*

CO trunks can also be connected to an outside line group. When the CO trunk "rings", Distributed Office automatically rings all the OLG member extensions. Additionally, it is possible to allocate an owner for an OLG, whose telephone will also ring when the OLG CO trunk rings. The owner can use a telephone type that does not support the key system user environment, for example, a SIP telephone.

A station is a member of an OLG if it has a matching "line appearance" button. The OLG members list is displayed in the "Members" tab of the OLG page. The owner of the OLG is configured in the General Tab of the Outside Line Group configuration dialog. Locate the "Owners Extension" in the drop down combo-box.

Note: The disadvantage to having an owner is that the owner cannot forward his telephone without forwarding the entire OLG. In other words, the OLG members cannot answer any more. The advantage to having an owner is that the OLG can then cover that ringing line to Voice Mail and the callers can leave messages.

4. Access Restrictions

4.1. *User Privilege Level*

The following privilege levels can be assigned to Distributed Office users (in the "General" tab of the "User" page):

- **Administrative**: Administrative users have all possible privileges for Distributed Office features. It is expected that no more than one user at each site will have this role. It must be a fairly sophisticated user, since the way that some standard features work is different (similar to CM users with "console permissions"), and careless usage of other features can compromise the security of the switch.

- **High:** This level should be assigned to the executives and managers in the branch. Same as the administrative user, except that they do not have console permissions

- **Medium:** This level should be assigned to general trusted staff in the branch. Same as the high-privileged user, except for:
    - They cannot forward calls off network
    - They cannot do trunk-to-trunk transfers with two public trunks
    - They cannot be a service observer
    - They cannot override restrictions on conference, transfer or forwarding
    - They cannot make toll calls
    - They cannot change coverage

- **Low**: This level should be assigned to telephones in break areas, the door telephones etc. These telephones don't belong to anybody in particular. They are the same as the medium privileged user, except that they:
    - Don't have voice mail
    - Cannot be forwarded
        - *Note:* Do not assign the "call-fwd" & "cfwd-bysda" buttons to such users.
    - Cannot use contact closure
    - Cannot make priority calls
        - *Note:* Do not assign the "priority" button to such users.
    - Cannot use data privacy
    - Cannot do facility access trunk tests
    - Cannot use directed call pickup

- *Note:* do not assign the "dir-pickup" to such users.

- **None:** This level should be assigned to telephones in copy rooms, the lobby, aisle, etc. Same as the low-privileged user, except that they:
  - Cannot make outside calls, except to emergency numbers
  - Cannot use the Automatic Callback Feature (ACB)
    - *Note:* do not assign an "auto-cback" button to such users.

Note: Distributed Office authorization code feature allows end users to change their privilege level temporarily, by entering a FAC and a password.

4.2. *Placing outgoing calls*

The "toll" column of the ARS table is used to mark PSTN prefixes that are restricted to "administrative" and "high" privileged users. For example the "1" prefix can be marked as "toll" in order to prevent regular users from placing long distance calls.

The "allow for all" ARS column is use to mark specific prefixes that users (even with the "none" privilege level) may dial. This field is automatically configured for prefixes with call type of "Emergency" or "crisis alert". However you can configure it manually for other prefixes (for example, to allow all users to place calls to the company's call center).

The ARS table processes all outside dialing, hence, the same behavior is applicable for key-system dialing via "line appearances" and outside dialing via "call appearances" and ARS FAC.

4.2.1. Interbranch calls

All users can place calls over the interbranch trunk.

5. Caller-ID and Connected Number Identification

Many trunking technologies allow the called PBX and the Service Provider to exchange the identities of the connected parties.

- CO and DID trunks allows the Service Provider to send the calling subscriber's number to the PBX. This capability is referred as "caller-id". The Service Provider can even change the "caller-id" during the call progress (e.g. if the calling subscriber forwards the call). However, the PBX can not send the identification of the connected extension to the Service Provider. You can configure the caller-id transmission in the "General" tab of the trunk group page.

- ISDN trunks allow both the Service Provider and the PBX to send the connected parties' information to each other. The feature is called "connected-number". Some implementations also support "connected-name". ISDN allows connected-number changes during the call for example, upon coverage or transfer.

- CAMA trunks allow the PBX to send the calling party number to the PSAP. This capability is mainly used for emergency calls.

- SIP trunks allow the calling party to send its identification to the called party in the "from" header. Implementations that support the P-ASSERTED-IDENTITY header can allow the called PBX to send the connected extension name and number back to the calling party and even change this parameter during the call. However, the standards around this area are not stringent, so not all terminals display the right numbers.

5.1. *Outgoing Calling Number Manipulation*

In Distributed Office, the "Outgoing Calling Number Manipulation" table converts the connected extension number to a number that can be sent to the service provider. This table is also used for generating a "connected-number" for incoming calls so we shall use the CM terminology for this table: PUN (Public Unknown Numbering) or PUN.

The following PUN table columns define the rules for matching:

- Extension Leading Digits: A prefix that needs to match the extension number.

- Trunk Group: Each rule (row) can match a single trunk group or "all" trunk groups.

Two fields define the PUN digit manipulation action:

- Digits to Prefix to form the Calling Party Number (CPN)

- Total CPN Length

The "Total CPN Length" defines the ANI length (number of digits) that will be sent to the trunk group. The digit string is first filled with the digits specified in the "Digits to Prefix…" column; the rest of the digits from the extension number.

Here are some examples:

Connected Extension Number	Matched PUN rule: "Digits to Prefix to Form Calling Party Number (CPN)"	Matched PUN rule: "Total CPN Length"	Number sent to the Service Provider
37561	732852	10	732852 7561
40001	7328528888	10	7328528888
33312	7328528888	10	7328528888
37701	645	7	645 7701

The ICHT converts the number from the SP to a local extension number; the configured PUN rules convert from the local extension number to the SP number. Therefore, in most cases the PUN is the inverse function of ICHT.

The matching PUN for the example in section 3.1.1 is:

Extension Leading Digits	Trunk Group	Digits to Prefix to Form Calling Party Number (CPN)	Total CPN Length
4001	PRI	8522888	7
330	PRI	852287	7
33	PRI	85228	7

Ensure numbers are generated for extensions that do not have DID. For example, if extensions 3310 to 3329 don't have a matching DID, you should add PUN rules that would send the Auto Attendant number (7328522888) instead by adding the following PUN rows:

331	PRI	8522888	10
332	PRI	8522888	10