



Basic Call and Contact Flow Concepts

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Relationships Between Tasks, Sessions, Contacts, and Channels

When installing and configuring Unified IP IVR, you must understand the concepts, call flows, and configuration dependencies explained in this section:

- **Task:** The Unified CCX receives the incoming call/contact signal on a *Trigger*, which is then assigned an *Application*. The application can be a workflow application, a CM Telephony application, (and in a Unified CCE system) an ICM Translation Routing application or an ICM Post-Routing application. When the Unified CCX accepts the contact, the application starts an application task. The application task in turn invokes an instance of a script associated with the application.
- **Session:** A session tracks *Contacts* as they move around the system. This enables information to be shared among contacts that are related to the same session.

When a contact is received (inbound) or initiated (outbound), the Unified CCX checks to see if an existing session already exists with that contact's Implementation ID. The Implementation ID is the Unified CM Global CallID plus the Unified CM node (GCID/<node>). If a session already exists for the contact, the Unified CCX associates it with that session. If there is no session for the contact, the Unified CCX automatically creates one.

After the contact ends, the session remains idle in memory for a default period of 30 minutes before being automatically deleted.

- **Contact.** A contact can be a *Call*, an *HTTP request*, or an *email*. A contact carries attributes such as creation time, state, language, and so on.
- **Channel.** Each type of contact can have various channel types associated with it. Channels are allocated and associated with contacts as needed and are used to support performing actions on contacts.

Different types of channels are allocated based on the type of contact and the type of dialogue that needs to be supported between the Unified CCX and the Contact. For example, a CM Telephony call that is presented to Unified CCX will be connected to a CTI Port. To support the call control event transfer, a Call Control channel is allocated.

If the Trigger is associated to a Primary and or Secondary Dialogue Group, depending on the type, a Media Channel or an MRCP channel will be allocated.

If an application is triggered by an HTTP Trigger, an HTTP Control Channel will be allocated.

Frequently Asked Questions about CM Telephony Call Flow Outside Unified CCE

When deploying your system, you should understand the following about call flows and the Unified CM configuration dependencies that can impact call flow:

- *How is a call presented to the Unified CCX system?*

Through the Caller, and then the CTI Route Point. An incoming call is given to the Unified CCX system on a *Trigger*, which is also called a *CTI Route Point*. The trigger signals the Unified CCX system through CM Telephony that there is an incoming call.

Unified CCX rejects the call if the *Max Session* limit has been hit for the Trigger or the Application to which the trigger is assigned.

If there are available sessions, based on the *Call Control Group* assigned to the trigger, Unified CCX searches for an available CTI Port to receive the call. If it finds an available port, it sends a request to Unified CM through CM Telephony/CTI requesting that the caller be rerouted from the CTI Route Point to the CTI Port.

The calling party is a GW (for a call from the PSTN) or an IP Phone (for an internal call into the system).

- *How does the Unified CCX system determine which CTI Port to use?*

A Unified CCX *Application* requires a *Trigger*. The trigger type determines whether or not a port will be required.

There are two types of triggers: CM Telephony and HTTP.

- If an application is started by dialing a phone number, it must have a *CM Telephony Trigger*.
- If an application is started by entering a URL, it must have an *HTTP Trigger*.

If an application is triggered by calling a CM Telephony Trigger:

- 1 The Unified CCX system looks for an available CTI Port in the *CM Telephony Call Control Group* assigned to the Trigger.
- 2 Unified CCX then requests the Unified CM to Redirect the caller to the desired *CTI Port*.
- 3 The call is presented to the CTI Port.

- 4 Unified CCX accepts the call on the CTI Port, the call rings on the CTI Port, and a Unified CCX script decides how to handle the call.

- *Why does the CM Telephony Trigger need to have Primary and or Secondary Dialogue Groups assigned to it?*

For the Unified CCX system to establish a media connection to a caller, Unified CCX must allocate a *Media Channel* for that call. When Unified CCX accepts a call on a CTI Port, it looks for an available Media Channel in the *Primary Dialog Group*. If there are none available, it will look for an available channel in the *Secondary Dialogue Group*.

- *What are the Unified CCX script call control choices?*

The call control step choices are:

Accept. Answers the call and establishes a media connection. This is based on the Primary and Secondary Dialogue Groups assigned to the Trigger. It can be either CMT (Cisco Media Termination) or ASR (Automatic Speech Recognition).

Reject. Rejects the call and returns it to Unified CM without answering it.

Terminate. Disconnects the Contact.

Redirect. Requests that Unified CM reroute the caller to another destination.

- *How are Redirects done?*

Redirects can be done in several ways:

- When Unified CCX requests that a caller be rerouted from a CTI Route Point to a CTI Port.
- When a Unified CCX script executes a Call Redirect step
- In Unified CCE, when a Unified ICME system sends a *Connect* request to the Unified CCX system to send a queued call to a destination label.

Once the Unified CCX system requests a Redirect and Unified CM accepts it, the redirecting CTI Port is released and returned to the idle port list.

HTTP Contact Flow Outside of Unified CCE

When an HTTP request is presented to Unified CCX:

- 1 The HTTP trigger is assigned to an application.
- 2 When the URL trigger is hit, an application task is started.
- 3 The application is assigned to a script and the script starts.
- 4 An HTTP control channel is allocated.
- 5 The script performs steps on the triggering contact.

Possible step choices are:

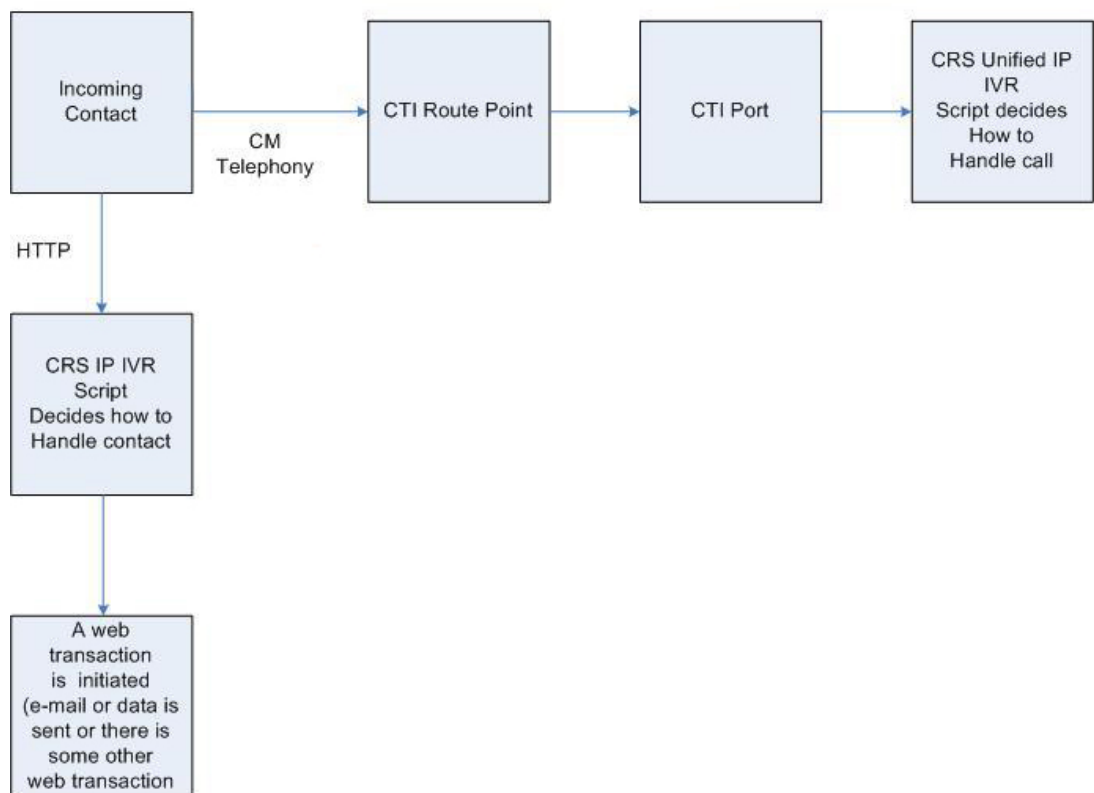
- **Get HTTP contact information.** Obtain Header Information, Parameters, Cookies and Environment Attributes and assign them to local variables.

- **Send a response.** Send a Document Object as a response to the calling browser.
- **Send a JSP reply.** Send a response to the calling browser based on a JSP template. This step allows for the mapping of local variables to keywords in the template.
- **HTTP redirect.** Allows a calling browser to be redirected to a different URL.

Summary of Unified IP IVR Contact Flow Outside of Unified CCE

The figure below shows a simplified block diagram of a contact flow outside of Unified CCE.

Figure 1: Basic Contact Flow Outside of Unified CCE



The following are the steps a call or contact takes within a Unified IP IVR system with Unified CM but without Unified CCE:

- 1 The caller dials the desired phone number or enters a Web address.
- 2 Unified CCX receives the contact signal at the phone number trigger point or the Web address trigger point.
- 3 Unified CCX determines which CTI port to take the contact on and sends a Redirect Request to CTI in the Unified CM to send the contact to the port:
 - If the contact is a call, then the Unified CCX system looks for a CTI port in the CM Telephony Call Control Group assigned to the trigger (the phone number).

- If the contact is a Web connection, then the Unified CCX system looks for a CTI port in the HTTP Control Group assigned to the trigger (the URL).
- 4 Unified CM sends the contact to the specified CTI port.
 - 5 The caller is presented to Unified CCX on the CTI port.
 - 6 Unified CCX accepts the call.
 - 7 Unified CCX starts an application that executes a CCX script.
 - 8 The script determines how to handle the call:
 - The Unified CCX script can Redirect the call (for example, when no agents are available). Or, the Unified CCX script can answer the call with the Accept step.
 - If the Unified CCX script answers the call and the trigger has been assigned a Dialog Group, Unified CCX establishes a media connection with the caller.

Important Unified CM Configuration Dependencies

Unified CM is a software ACD that distributes calls. The Unified IP IVR software tells Unified CM how to distribute calls. For both products to work together correctly, you should therefore understand how calls are set up when you configure the Unified CM devices.

You should be aware of the following:

- **Repository Datastore.** The IDs resides on the Unified CCX server in the MSDE or SQL2K database. It holds the prompts, grammars, documents, and scripts used by the system.
- **CTI Ports and Route Points.** When configuring Unified CCX in the Unified CCX Administration web page, you must enter the information that Unified CCX uses to configure CTI Ports and Route Points in Unified CM.
- **CM Telephony User.** When configuring Unified CCX, you define a CM Telephony User Prefix that is used to create the CM Telephony User in the Unified CM.
- **Redirects.** Redirects are performed when a call comes and the call is sent from the route point to the designated CTI port (in this case, the redirect takes place internally as part of the protocol), when a Unified CCX script executes a call Redirect step, or when a Unified ICME system sends a Connect request to the Unified CCX system to send a queued call to a destination label.

When the Redirect is performed, if the Unified CM destination is available, the call is immediately sent to the Unified CM and released from the CTI Port.
- **Destination.** A Redirect will fail if the destination is not available.
- **Redirect Calling Search Space.** Unlike the redirect that the Route Point does to the CTI Port (which is not configurable), the CSS used for a redirect for a call that is already established on a CTI Port is indeed controlled by the Redirect Calling Search Space parameter in the Call Control Group config.
- **Calling Search Space.** Calling search spaces (CSS) determine the partitions that calling devices, including IP phones, SIP phones, and gateways, can search when attempting to complete a call. A collection of partitions are searched to determine how a dialed number must be routed. The CSS for the device and the CSS for the directory number get used together. The directory number CSS takes precedence over the device CSS.

See [Cisco Unified Communications Manager Maintain and Operate Guides](#) for more information.

- **Device Regions.** Regions determine the maximum bandwidth codec that is allowed for calls both intra- and inter-region, not the codec itself. In the case of the Unified CCX servers CTI Ports, if the connection to calling or called device cannot be made at the Unified CCX servers installed bandwidth, then a Transcoder channel must be available.



Warning

If you install Unified CCX with the default codec (G.711), your region configuration must allow calls into the region assigned to the CTI Ports at G.711. Otherwise, calls across the WAN are forced to G.729 in the region configuration, which causes the call to fail if there are no hardware transcoding resources properly configured and available.

See [Regions Configuration](#) for more information.

- **Device Locations.** In the event that one or more of the devices are in a location, if sufficient bandwidth is not available, the requested call-control operation will fail.

See [Location Configuration](#) for more information.

- **Media Connections.** Media connections to the Unified CCX system are either all G.711 or all G.729. This means that the Unified CM region configuration must allow for connections between devices and the Unified CCX server CTI Ports with the appropriate Codec. If not, then Transcoder channels **MUST** be configured and available. You do this at the appropriate matching Codec at Unified CCX installation time.
- **Connection path device (Codec).** When you create a region, you specify the codec that can be used for calls between devices within that region, and between that region and other regions. The system uses regions also for applications that only support a specific codec; for example, an application that only uses G.711.

How Calls Go through the Unified CCE System

This section describes the following:

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- [Two Ways of Configuring Unified IP IVR with Unified ICME](#), on page 7
- [Post-routed Call Flow Scenario](#), on page 8
- [Translation-Routed Call Flow Scenario](#), on page 9
- [ICM Subsystem](#), on page 10
- [Service Control interface](#), on page 10
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Call Flow Control

The Unified ICME system is a major component of the Unified CCE system. Unified ICME provides a central control system that directs calls to various human and automated systems, such as Integrated Voice Response (IVRs) units [also called Voice Response Units (VRUs)] and Automatic Call Distribution (ACD) systems.

Unified CCX scripts can direct calls based on various criteria, such as time of day or the availability of subsystems. When used with Unified ICME in a Translation Routing or Post Routing Application, the Unified IP IVR system does not make decisions as to what script to run. Instead, Unified ICME controls the call treatment by issuing RUN_VRU_SCRIPT commands to Unified IP IVR system. These RUN_VRU_SCRIPT commands tell Unified IP IVR which Unified CCX script to run.

ICM scripts use four different commands to interact with the Unified IP IVR system:

- **Connect** - To connect the call. The Unified ICME system sends the connect message with a label to instruct the Unified IP IVR system where to direct the call.
- **Release** - To hang up a call.
- **RUN_VRU_SCRIPT** - To run an ICM VRU script on the Unified IP IVR system.
- **Cancel** - To cancel the ICM VRU script currently running.

Two Ways of Configuring Unified IP IVR with Unified ICME

When integrated in a Unified CCE environment, Unified CCX can be used in two different ways depending on the call flow.

You can define your Applications as either post-routing or translation-routing applications.

- **Post Routing**. If the calls will first traverse through the Unified IP IVR and then through Unified CCE, it is considered a Post-Routing scenario. In this type of call flow, Unified CCE is notified of the call by Unified CCX. The ICM script will not start until Unified CCX requests instructions from Unified CCE after the Unified CCX Initial Script ends (if one is configured).

An example would be when a caller is prompted by Unified CCX for some information that is intended for subsequent delivery to a Unified CCE Agent.

- **Translation Routing**. If Unified CCE first has control of the call and it needs to flow through the Unified IP IVR, it is considered a Translation-Routing scenario. In this type of call flow, the call is under Unified CCE script control when arriving at Unified CCX.

Examples of this call flow are when you have to queue a caller or if you use the Unified IP IVR for menu based (CED) routing.

**Note**

The Unified ICME system and the Unified CCX system together form the Unified CCE system. In a Unified CCE environment, the Unified ICME software is the *primary controller* of all calls. The Unified CCE queuing is done through the Unified CM and Unified CCX software. The agent assigned by the software to handle a call can be defined in either the Unified CM database or the Unified ICME database.

Post-routed Call Flow Scenario

This scenario represents a call that is queued in the Unified IP IVR system through Post Routing until an agent becomes available.

In a post-routed call flow:

- 1 The caller dials the desired phone number (an application Trigger that is a Unified CCX Route Point).
- 2 The trigger is linked to a Post-Routing application with a default Unified CCX script.
- 3 The call is presented to the Unified CCX system.
 - a The Unified CCX system looks for a CTI port in the CM Telephony Call Control Group assigned to the trigger (the phone number).
 - b The Unified CCX system determines which CTI Port to take the call on and sends a redirect request to Unified CM through the CM Telephony protocol.

If no ports are free, the caller hears a "fast busy" until there is a free port to take the call.
 - c Unified CM sends the caller to the specified CTI Port.
 - d The caller is presented to the Unified CCX system on the CTI Port.
 - e The default Unified CCX script linked to the application is run.
- 4 The Unified CCX script then determines what to do next:
 - a In most post-routing cases, the script will welcome the caller and collect some information from the caller to be sent over to the Unified ICME system.
 - b The script maps this data using the Set Unified ICME data step.
 - c The script ends with the End step.
- 5 Since this is a post-routing application, once the End step is reached, the Unified CCX system requests instruction from the Unified ICME system.

This instruction is a route request with the VRU peripheral as the routing client and the Unified CCX Route Point as the DN.
- 6 The Unified ICME system will have an ICM script configured to run for this routing client DN. After it is notified of the call, the Unified ICME system runs the ICM script.
- 7 The ICM script will determine how to handle the call and will instruct the Unified CCX system accordingly.

ICM scripts are composed of many different call-handling steps, including the following four commands it can send to the Unified CCX system-connect, Release, Run VRU Script, and Cancel.
- 8 The Unified CCX system responds to the commands from the Unified ICME system until the Unified ICME system signals that the call is complete.

For example, the ICM script could send a Run VRU Script request to the Unified IP IVR system, instructing the Unified IP IVR system to run a script that plays music and thanks the caller for their patience. When an agent becomes available, the Unified ICME system sends a Cancel request and the Unified IP IVR system stops running the current script.

The Unified ICME system then sends a Connect command with a Normal label that indicates the extension of the free agent. The Unified CCX system then checks the VRU Script Name variable to determine if it

needs to run a PreConnect script. The Unified CCX system routes the call to the agent indicated in the Normal label.

Translation-Routed Call Flow Scenario

This scenario represents a call that is queued in the Unified IP IVR through Translation Routing until an agent becomes available.

In a translation-route call flow:

- 1 The caller dials the desired phone number (an application Trigger that is a Unified ICME Route Point).
- 2 The call is presented to the Unified ICME system.
- 3 An ICM script is started. Based on the ICM script logic, the caller is queued for a group of agents. If none are available, the caller is queued in the Unified IP IVR as follows:
 - a The caller is translation routed to the Unified IP IVR by the PG (the ICM Peripheral Gateway) sending a redirect request to CTI through CM Telephony. The destination is a Unified CCX Translation Route Point (Trigger).

The Unified ICME system sends along with the call additional information associated with the call, including a reserved DNIS value, a trunk group, a label for the PG, and instructions for further processing.
 - b The call is presented to the Unified CCX system on the trigger.
 - c The Unified CCX system looks for a CTI port in the CM Telephony Call Control Group assigned to the trigger (the phone number).
 - d The Unified CCX system determines which CTI Port to take the call on and sends a redirect request to through CM Telephony.
 - e The Unified CM sends the caller to the specified CTI Port.
 - f The caller is presented to the Unified CCX system on the CTI Port.
 - g The Unified CCX system accepts the call, starts a session with the ICM PG, and sends a REQUEST_INSTRUCTION request.
- 4 The ICM script then determines what to do next. In most cases, it sends a RUN_VRU_SCRIPT request to the Unified CCX system.
- 5 The Unified CCX system maps the requested VRU script name to a Unified CCX Script based on the VRU Script configuration in the Unified CCX system.
- 6 The Unified CCX script then determines how to handle the call. A call can either be redirected or answered with the accept step.
- 7 If the Unified CCX script answers the call, and the trigger has been assigned a Dialogue Group, it establishes a media connection with the caller. At this point the Unified CCX system can interact with the caller as desired.
- 8 When the script ends, it sends a RUN_SCRIPT_RESULT message back to the Unified ICME system. The ICM script determines what to do next. Typically another RUN_SCRIPT_REQUEST events is sent. This continues until an agent becomes available to take the call.

- 9 Once an agent becomes available, the Unified ICME system sends a CANCEL message to the Unified CCX system.
- 10 The Unified CCX system terminates the running script.
- 11 The Unified ICME system then sends a CONNECT message that includes the Agent's extension as the Label.
- 12 The Unified CCX system then redirects the caller to the agent's extension.

ICM Subsystem

The ICM subsystem of the Unified CCX system allows Unified IP IVR to interact with the ICM system. The ICM subsystem of Unified CCX uses a proprietary protocol to communicate with the ICM PG.

When using the ICM subsystem, you should understand:

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- [Labels](#), on page 10
- [VRU Scripts](#), on page 11
- [Expanded Call Variables](#), on page 11
- [Script Parameter Separators](#), on page 11

Service Control interface

The Service Control interface allows the Unified ICME system to provide call-processing instructions to the Unified IP IVR system. It also provides the Unified ICME system with event reports indicating changes in call state.

The Service Control Interface is enabled from the Unified CCX ICM subsystem configuration web page.

Labels

The Service Control interface supports four label types:

- Normal

The Normal label is a character string that encodes the instructions for routing the call. It contains either a directory number to which the Unified IP IVR system should route the call or the name of a .wav file representing an announcement.

If you configure the Unified IP IVR system to send an announcement, the Unified IP IVR system plays the .wav file, pauses for two seconds, and repeats the .wav file followed by the two second pause three additional times. Then it pauses 8 seconds and plays a fast busy signal until the caller hangs up.

- Busy

The Busy label indicates that the caller should receive a busy treatment. Unless you set up a Busy label port group to handle the call, the Unified IP IVR system generates a simulated busy signal from a .wav file until the caller hangs up.

- Ring No Answer

The Ring No Answer (RNA) label indicates that the caller should receive an RNA treatment. Unless you set up a Ring No Answer label port group to handle the call, the Unified IP IVR system generates a simulated ringing sound from a .wav file until the caller hangs up.

- Default

The Default label indicates that the Unified IP IVR system should run the default script.

VRU Scripts

The scripts that control Unified IP IVR calls have a VRU Script name in the Unified ICME system that must be properly mapped to a Unified CCX script name (.aef file) in the Unified CCX system. This mapping is done from the Unified CCX ICM subsystem configuration web page.

Expanded Call Variables

Data is passed back and forth between the Unified ICME system and the Unified CCX scripts using *Expanded Call Variables*. There are 10 default variables available, but others can be configured. Since these variables are used globally throughout the system, they are considered to be premium and should only be used when necessary. Expanded Call Variables are configured both in the Unified ICME system and in the Unified CCX system. In the Unified CCX system, they are configured from the Unified CCX ICM subsystem configuration web page.

Script Parameter Separators

One function that can prove useful is the ability to use the Unified ICME RUN_SCRIPT node with a name that includes parameter separators. The Parameter Separator is defined from the Unified CCX ICM subsystem configuration web page. By default it is the | (pipe) symbol.

One example of its usefulness is if you have one main script. Within that script, you can have multiple branches that would execute based on the value of a parameter that is passed by the Unified ICME system.

Example

Configuration data:

- Cisco Unified CCX Script name = testscript.aef
- VRU Script name = *testscript* ICM VRU Scripts
- Run VRU Script node in Unified ICME = testscript|100

Get ICM Data step in script testscript.aef:

- Field Name: VRU Script Name
- Token Index: 1
- Decoding Type: String
- Local Variable: param1 (of type string)

In the preceding example of a script parameter separator, the script variable *param1* will contain the first parameter (after the |) In this case, that would be 100. This example allows the variable *param1* to be tested and for the script to take the desired branch based on its value. The benefit is that only one VRU Script needs to be defined in the Unified CCX system, and you do not have to use any other variables as parameters to determine which branch to take in the script.

**Note**

When you use parameter separators in Unified CCX, the Unified ICME script name must include the parameter as part of its name. If you want to pass a different parameter like “testscript|200” then you need to configure another VRU script on the Unified ICME system and name it testscript|200.

For more information on script parameters, see the *Cisco Unified Contact Center Express Editor Step Reference Guide* and the *Cisco Unified Contact Center Express Getting Started with Scripts*.

Debugging Problems in the Unified IP IVR System

The SS_TEL or SS_SIP (Telephony subsystems) debug traces can be used to debug the CM Telephony aspect of a call.

When debugging Unified ICME problems in the Unified IP IVR system, turn on the ICM related debugs. The Unified CCX LIB_ICM (ICM library) and the SS_ICM (ICM subsystem) show the Unified ICME events messaging. Use the *Cisco Unified Contact Center Express Solutions Servicing and Troubleshooting Guide* for instructions on how to interpret the messages and how to use Trace.

Important Unified ICME Configuration Dependencies

When configuring your Unified IP IVR system in an Unified CCE environment, you need to be aware of the following:

- The DNs (*Dialed Numbers*) of the Route Points, that is, the triggers that you configure in the Unified CCX system are used in the Unified ICME system as *Translation Route DNIS*'. As such, it is critical that these DNs match the Translation Route DNIS' you configure in ICM. If you fail to do this, Translation Routing will not work and calls will be dropped.

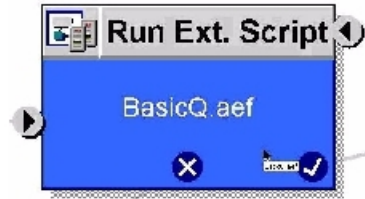
For example, if your Translation Route DNIS pool has DNIS' 5000, 5001, 5002, and 5003 in it, then you must create four Route Points, each with one of those numbers as the DN of the Route Point.

So, your configuration might look like this (the names are up to you, but the DNs are mandatory):

- TRRoutePoint1 – DN 5000
 - TRRoutePoint2 – DN 5001
 - TRRoutePoint3 – DN 5002
 - TRRoutePoint4 – DN 5003
- The *CTI port group number IDs* in Unified CCX must have the same numbers as the *peripheral trunk group numbers* in the Unified ICME system.

- It is imperative that the *script name* referenced in your Unified ICME Run External Script node matches what is configured in the VRU Script List configuration in the ICM Subsystem on Unified CCX.

Figure 2: The Script Name Referenced in your ICM Run External Script Node



In order to eliminate any confusion, name the Unified CCX script exactly the same in all places.

Consider the example **BasicQ.aef** script provided with your Unified CCX server. Obviously, this is the script name by which Unified CCX will know the script. However, you can refer to this script in a Run External Script node in Unified ICME by whatever name you want. The VRU Script List configuration in Unified CCX Application Administration application is where you couple the ICM External Script name with the Unified CCX script name.

Figure 3: Matching the ICM Script Name with the Unified CCX Script Name

ICM Configuration		
General	VRU Script Name ▾ ▲	Script ▾ ▲
ICM VRU Scripts	BasicQ.aef	BasicQ.aef

- The VRU Script Name column on the left is the name that Unified ICME will refer to when calling the script and the Script column on the right is the file name of the Unified CCX script you want to run when Unified ICME calls the script mentioned in the VRU Script Name column.
- As you can imagine, if you refer to these scripts by different names in Unified ICME and Unified CCX, it can become confusing when it comes time to troubleshoot. Thus keep these names exactly the same. This way there is no ambiguity as to what script you are referring to.
- The *VRU connection port numbers* in Unified CCX must be the same as the *VRU connection port numbers* in the Unified ICME system.
- Any *enterprise ECC (Expanded Call Context) variables* must be defined on both sides of the system (in Unified IP IVR and in Unified ICME software).

