

*Your  
Logo*

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**Network Architectures**

## **Lesson Objectives**

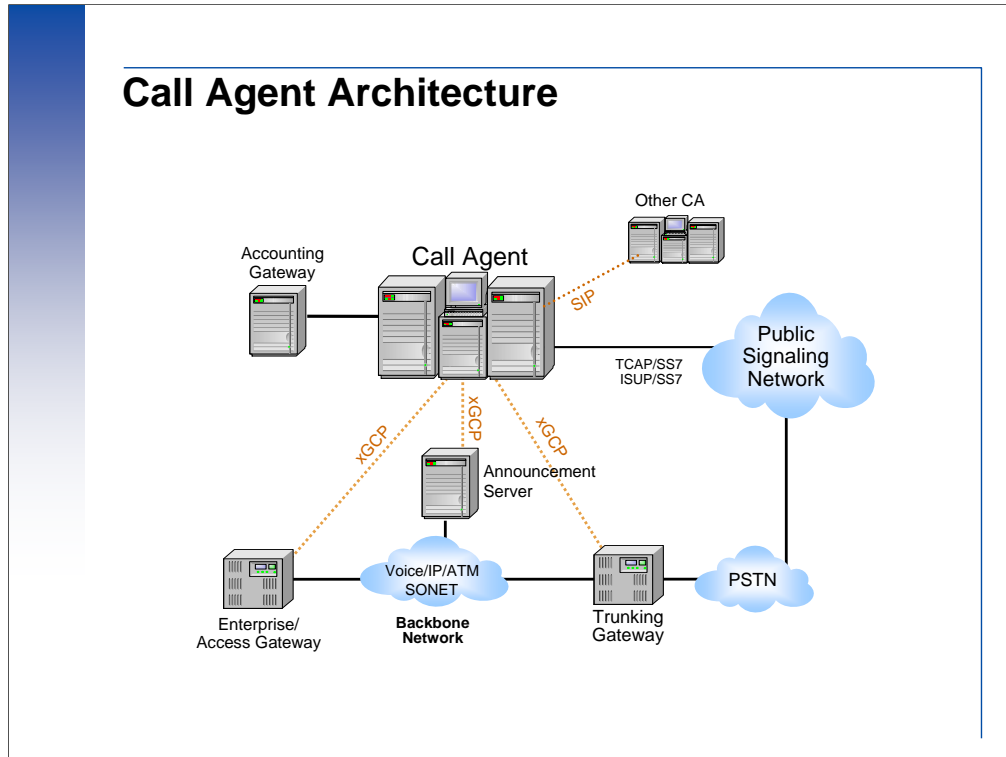
- **Identify the major components of the Network Architecture.**
- **Describe the functions of the network components.**
- **Identify which technical specifications are used to define the network.**
- **Describe the functions of the S/MGCP Call Agent (CA) interface.**

### **Lesson Objectives**

At the end of this lesson the learner will be able to:

- Identify the major components of the Network Architecture.
- Describe the functions of the network components.
- Identify which technical specifications are used to define the network.
- Describe the functions of the S/MGCP Call Agent (CA) interface.

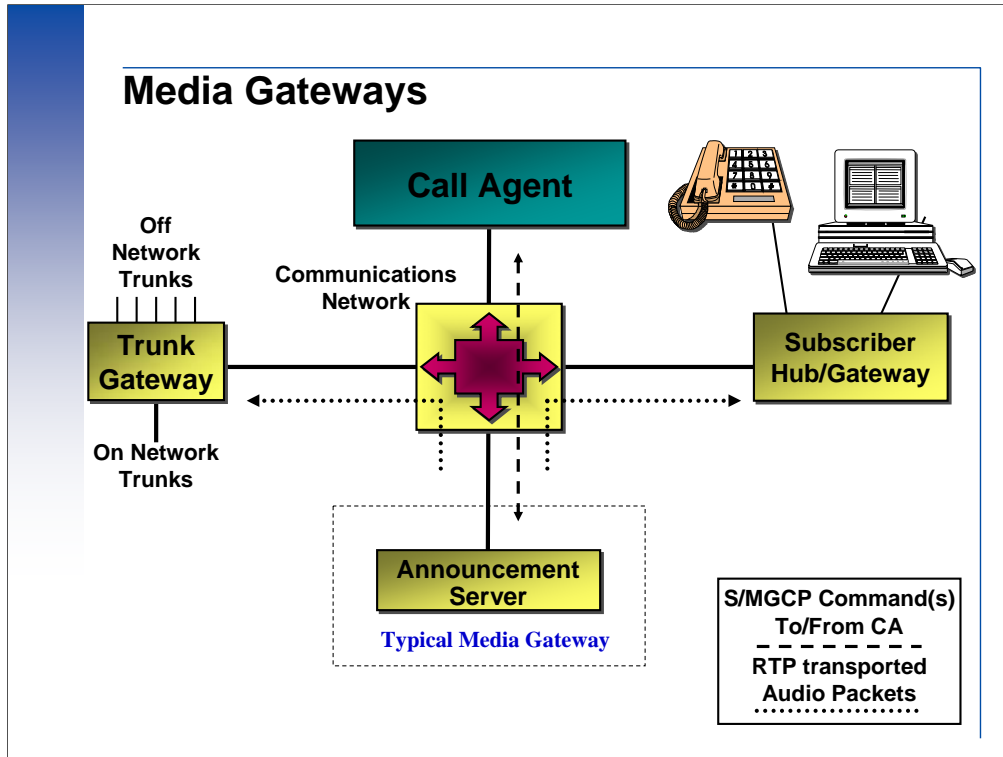
## Call Agent Architecture



### Call Agent Architecture

In the S/MGCP/Megaco model, the Call Agent (CA) handles the call processing and signaling functions. The call processing may include the support for supplementary services beyond the normal call setup/teardown.

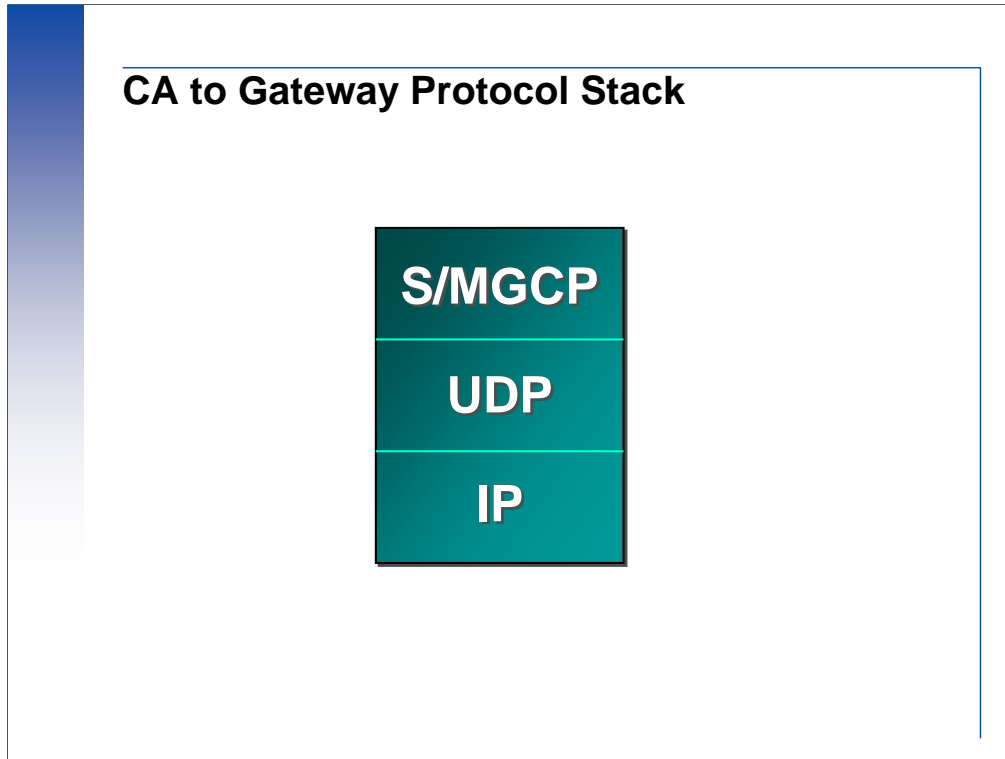
Implementing the signaling functions in the CA may allow the CA to also act as the “Gatekeeper” for the Signaling Gateway (gateway defined in H.323 networks) for interface to other networks (such as the SS7 network gateway).



## Media Gateways

The Media Gateways focus on the audio transmission and interface functions of the network. Typically Media Gateways convert the media from one network to the media of another network (such gateway ISDN to IP). Examples of Media Gateways include:

- Trunk Gateways used to interface with the Switched Circuit Network (PSTN, PBXs, etc.)
- Trunk Gateways that interface two dissimilar networks, such gateway IP and ATM networks
- Access Gateways or Hubs that interface to subscriber side connections such gateway analog lines, ISDN interfaces, LANs, etc. Access gateways may also be called Residential gateways if they are used to provide network access for residential customers
- Network Access Servers that may provide modem pools, or data access
- Announcement Servers, which provide non-interactive announcements for call progress/call failure treatment and interactive announcements that, can be used for supplementary services.



### **Call Agent to Gateway Protocol Stack**

Communications between the Call Agent (CA) and the media gateway uses one of the following protocols:

Simple Gateway Control Protocol (SGCP)

Media Gateway Control Protocol (MGCP)

Megaco Media Gateway Control Protocol (MEGACO)

The media gateway control protocols do not perform their own transport and must rely on other protocols for transport and routing. S/MGCP packets typically will be transported over the User Datagram Protocol (UDP) and Internet Protocol (IP).

## **S/MGCP Parameters**

### **CRCX/MDCX/DLCX**

<u>Parameter</u>	<u>Description</u>
(M) C: Call_Id	A unique call identifier
(M) Endpoint_Id	<i>announcement_name / play instructions</i>
(O) Notified_Entity	
(M) Connection_Mode	inactive or send-only
(C) Remote_Connection_Descriptor	receiving endpoint (SDP format)
(M) Local_Connection_Options	announcement characteristics
(O) Requested_Events	
(C) Request_Identifier	

### **S/MGCP Parameters**

The S/MGCP messages can contain command values and data parameters that inform the receiver of what operations to perform and what data values to use to when performing the operation.

A Create Connection (CRCX) or Modify Connection (MDCX) command will be used to set up a connection between endpoints or to call an announcement.

Some of the values sent in a CRCX/MDCX command are shown here.

## **S/MGCP Parameters**

### **Notify**

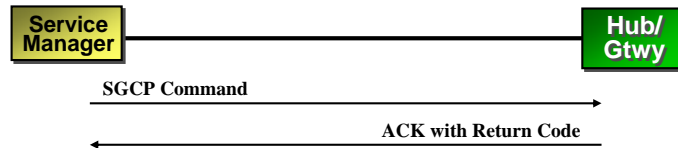
<u>Parameter</u>	<u>Description</u>
(M) Endpoint_Id	<i>announcement_name / play instructions</i>
(M) Request_Identifier	
(O) Notified_Entity	
(C) Remote_Connection_Descriptor	receiving endpoint (SDP format)
<u>NTFY Only</u>	
(M) Observed_Event	

### **S/MGCP Parameter - Notify**

The S/MGCP NOTIFY command may contain the values listed here.

A NOTIFY could be used to indicate a change has occurred on the network that requires action.

## SGCP Return Codes



**Return Codes are divided into ranges indicating success or failure. The following are defined categories:**

- values between 100 and 199 indicate a provisional response,
- values between 200 and 299 indicate a successful completion,
- values between 400 and 499 indicate a transient error,
- values between 500 and 599 indicate a permanent error.

### S/MGCP Return Codes

All SGCP/MGCP commands are acknowledged. The acknowledgment carries a return code, which indicates the status of the command.

When communicating between the CA and network endpoint, return codes will indicate success or failure. Examining the return code can indicate whether or not a problem exists and what the problem is.

The return code is sent by the gateway as an integer number, for which four ranges of values have been defined:

- values between 100 and 199 indicate a provisional response,
- values between 200 and 299 indicate a successful completion,
- values between 400 and 499 indicate a transient error,
- values between 500 and 599 indicate a permanent error.

All return codes are listed in RFC 2705 published by the Internet Engineering Task Force (IETF). A current copy is listed in the Appendix of this workbook.

## **M/SGCP Response**

### **Response to a CRCX/MDCX command:**

**200 1234 OK (1234 is transaction id)**

**I: (connection id)**

**v=0**

**c=IN IPv4 (port #)**

**m=audio (annc#) RTP/AVP 0**

## **S/MGCP Response**

For each command sent from the CA to the gateway, the gateway should send a response with the appropriate “Return Code”

The format of the response messages is gateway follows:

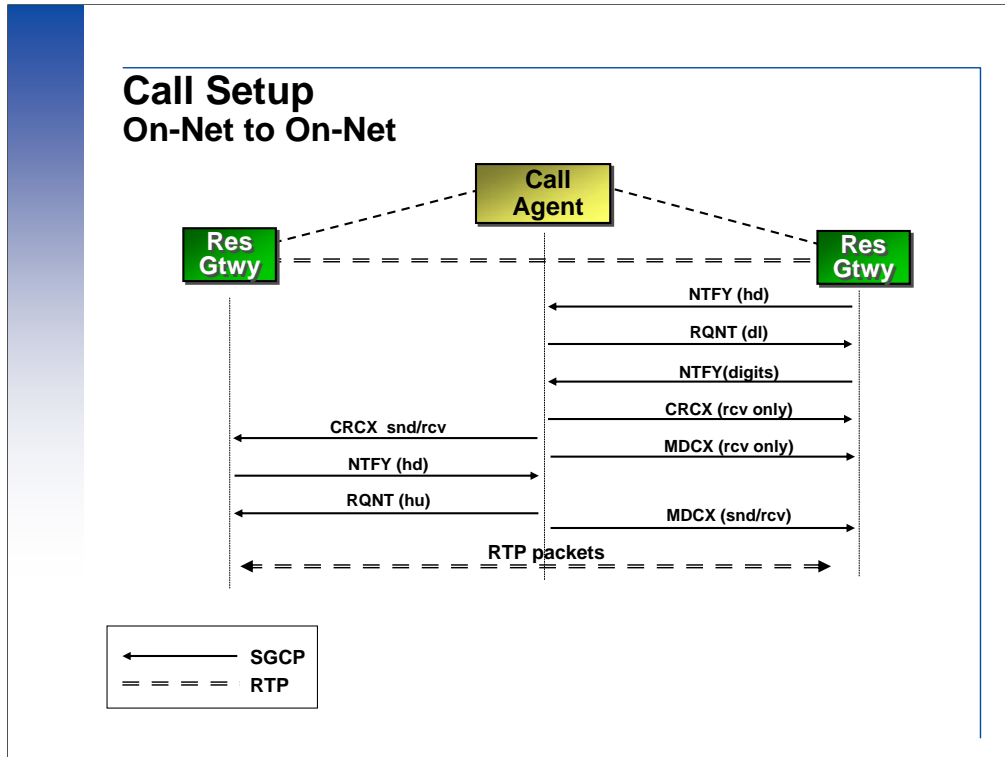
*200 1234 OK (1234 is transaction id)*

*I: (connection id)*

*v=0*

*c=IN IPv4 (port #)*

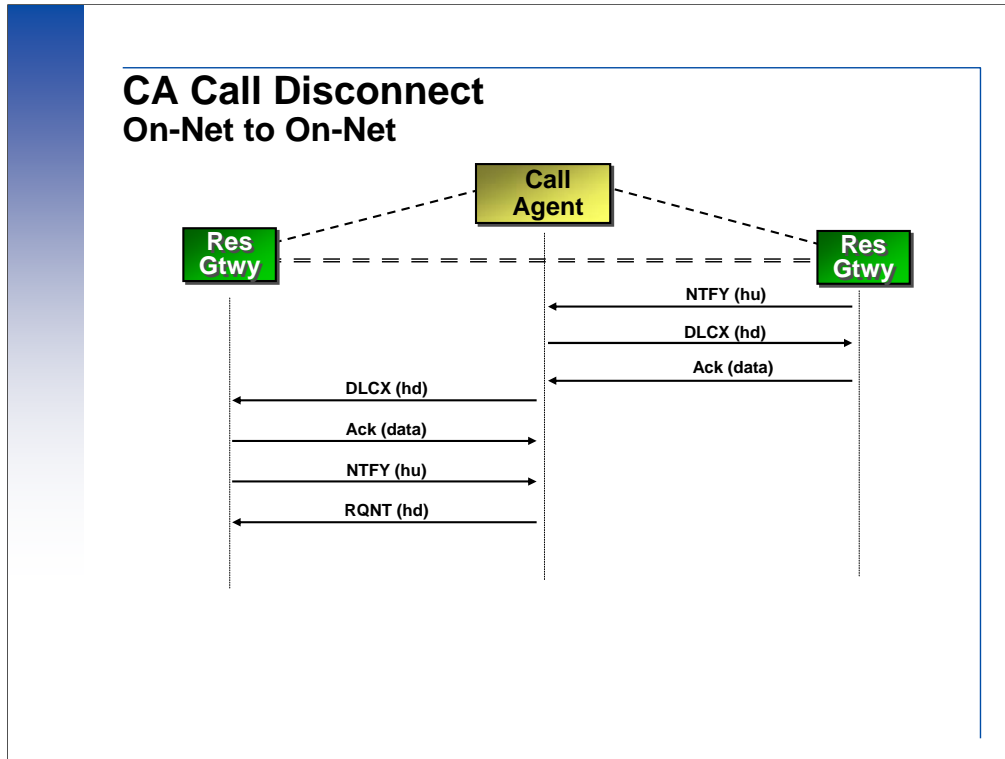
*m=audio (annc#) RTP/AVP 0*



### Call Setup – On-Net

Typical On-Net to On-Net calls only require S/MGCP messages. This example shows a typical sequence.

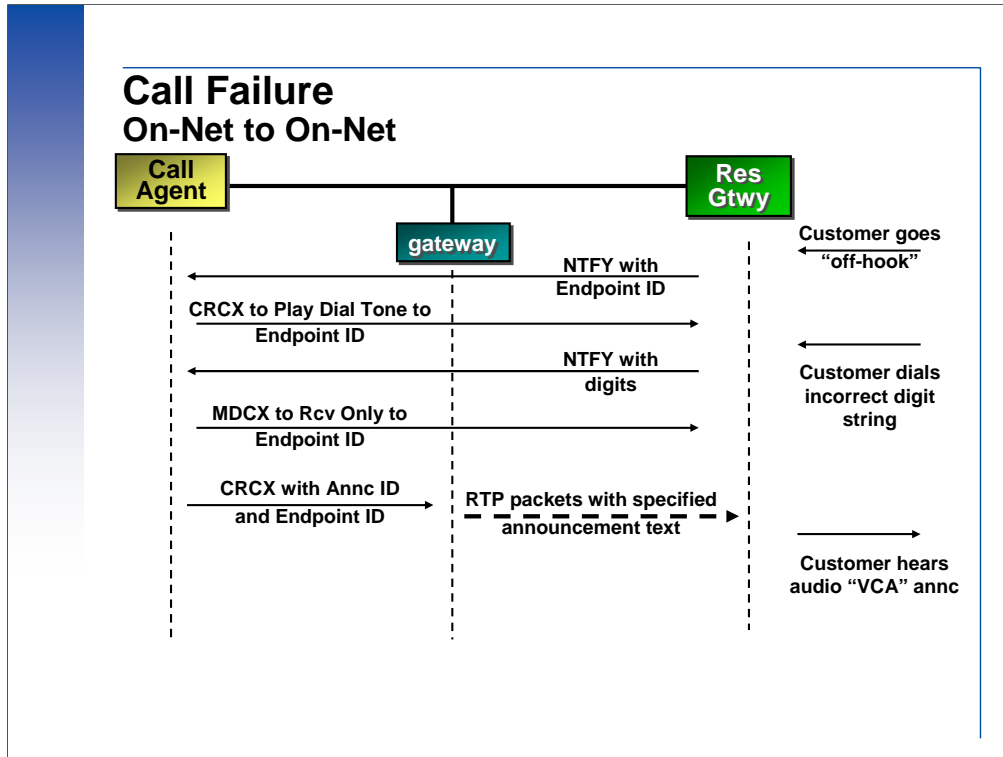
**Note:** ACKs are generated for all S/MGCP commands, but are only shown here for the CRCX commands. These two ACK messages are shown because they include the endpoint identities and RTP connection parameters for voice/data transfer.



### Call Disconnect –On-Net

Typical On-Net to On-Net calls only require S/MGCP messages. This example shows a typical sequence.

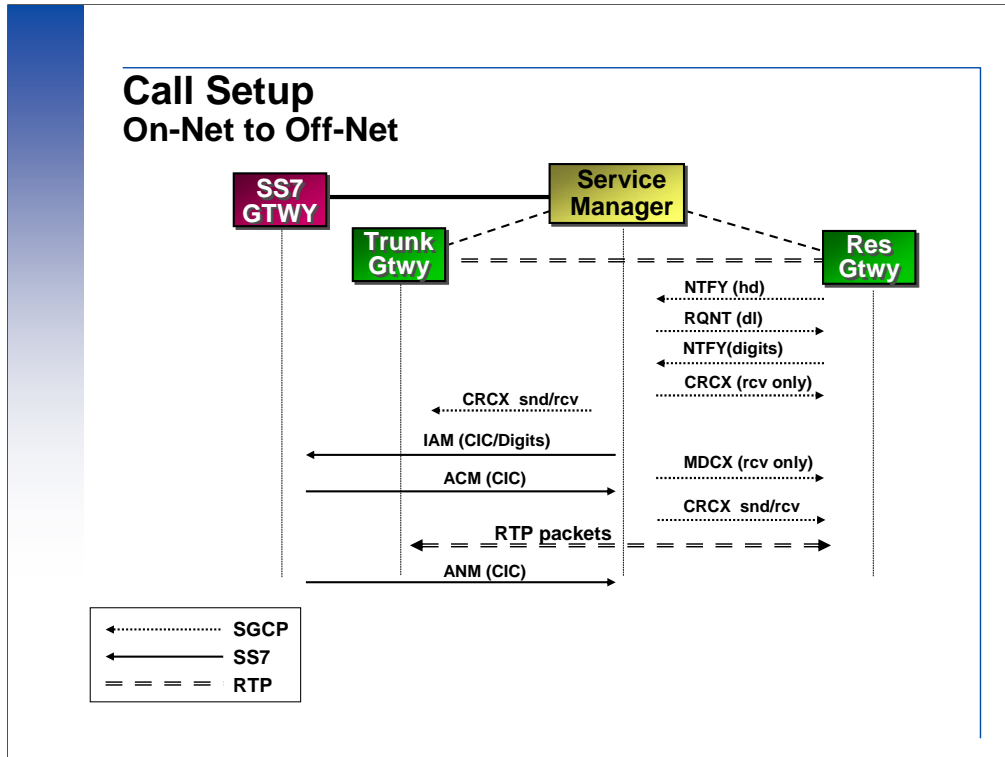
Note that ACKs are generated for all S/MGCP commands, but are only shown here for the CRCX commands. These two ACK messages are shown because they include the endpoint identities and RTP connection parameters for voice/data transfer.



### Call Failure – On-Net

Here a “On-Net” subscriber attempts an outgoing call that cannot be routed by the Call Agent. This could be the result of an incorrect or incomplete digit string having been received by the Residential Hub/Gateway or a translation problem in the CA.

When the CA receives the Notify request from the Residential Gateway it will attempt to determine a route (either on-net or off-net) to connect the subscriber to. Since the digits are invalid, the CA determines (through its routing tables) that no route exists but that an announcement is appropriate. It sends a Modify Connection back to the gateway indicating a “receive only” connection for the subscribers end point. Using a new CRCX, the CA directs the gateway to play an announcement (vacant code in this example). The gateway then sends the audio announcement to the specified end point using Real-Time Transport Protocol (RTP).



### Call Setup – Off-Net

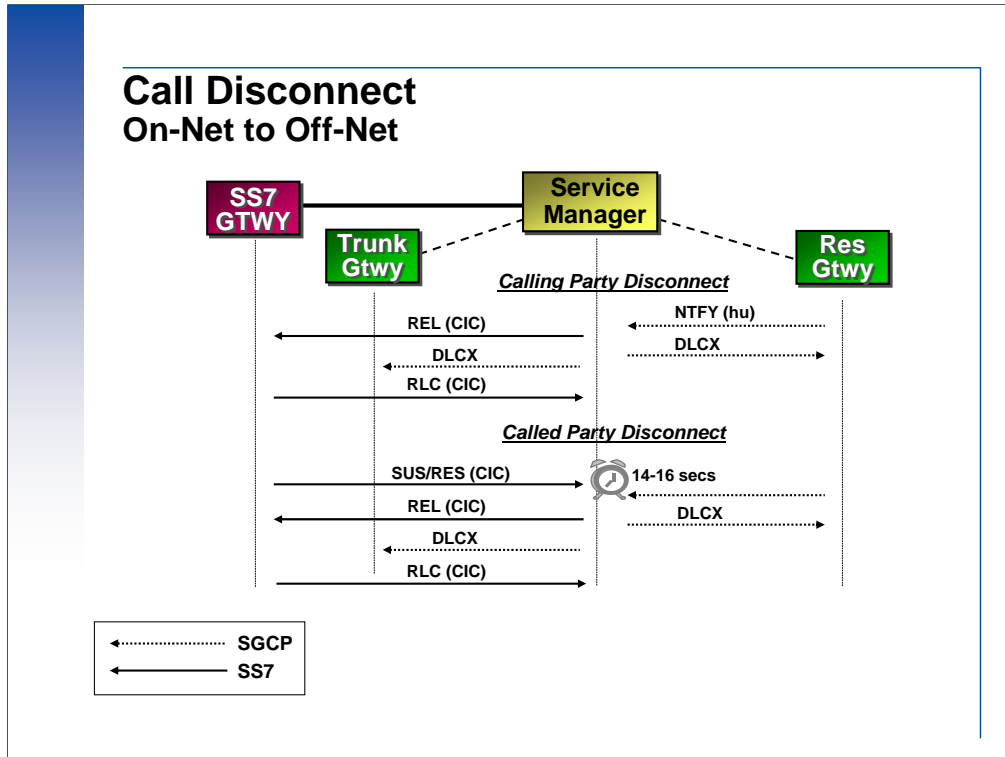
This example shows a typical call flow for an incoming “Off-Net” call that results in the call completing to the destination.

The incoming call starts with the receipt of an Initial Address Message (IAM) from the SS7 Gateway. The SS7 Gateway sends the Circuit Identification Code (CIC) and both Called and Calling Party digits to the CA. The CA it will attempt to determine a route to the terminating subscriber.

The CA sends a Create Connection to the trunk gateway indicating a “receive only” connection to the calling party. The CA also sends a CRCX to the Residential Hub to play ringing.

CA sends an SS7 message to the SS7 Gateway to issue an Address Complete Message (ACM) to the originating network. And then sends a MDCX to the trunk gateway to set it to the Send & Recv mode.

When the subscriber answers the Res Hub sends a NTFY command to the CA to generate a call completion record. The CA in turn sends an SS7 Answer Message (ANM) to the originating network. The two gateways will now send Real-Time Transfer Protocol (RTP) packets to between the end points to transfer the subscriber voice/data.



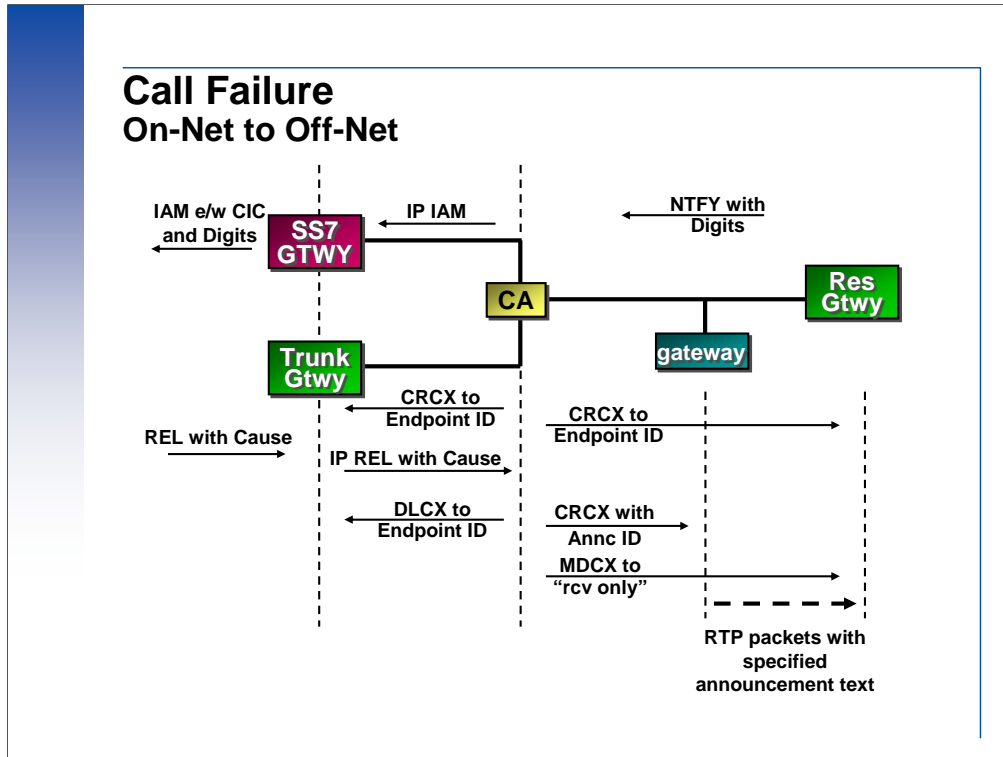
### Call Disconnect – Off-Net

This example shows disconnect procedures for an outgoing “Off-Net” call.

Outgoing calls give allow the Calling Party to control the disconnect procedures. If the Calling Party disconnects, teardown is initiated immediately.

If the Called Party disconnects first (gateway assuming the Calling Party stays “off-hook”) a Suspend message will be sent to initiate a timer at the near end. This timer (14-16 seconds) will allow the call to remain in progress until the Calling Party disconnects or the timer expires.

In this example the timer will expire causing the CA to begin disconnect procedures.



### Call Failure – Off-Net

The Announcement Server system is used to deliver audio announcements to “end points” in a Voice over IP (VoIP) network.

This example shows a typical call flow for an outgoing “Off-Net” call that results in the call failing after being sent to the interconnecting network.

The outgoing call starts with the Residential Gateway sending the call information to the CA. The CA after validating the route sends an Initial Address Message (IAM) through the SS7 FE and out to the SS7 network.

When the CA sends a Create Connection (CRCX) to the Trunk and Res Gateways to support the potential call.

Call processing fails in interconnecting network (for a variety of reasons) and consequently an SS7 Release (REL) is received from the interconnecting network. The “Cause Value” will determine which announcement is appropriate for this call.

The CA sends a Delete Connection (DLCX) to the trunk gateway. The CA will send a CRCX to the gateway indicating the announcement required and will send an MDCX indicating a “receive only” connection to the calling party.

The gateway then sends the audio announcement to the specified end point using Real-Time Transport Protocol (RTP). The Residential Gateway sends the digitized announcement contained in the RTP packets to the originating caller.

## **Lesson Review**

- **Identified the major components of the Network Architecture.**
- **Described the functions of the network components.**
- **Identified which technical specifications are used to define the network.**
- **Described the functions of the S/MGCP Call Agent (CA) interface.**

### **Lesson Objectives**

In this lesson we have discussed the following:

- Identified the major components of the Network Architecture.
- Described the functions of the network components.
- Identified which technical specifications are used to define the network.
- Described the functions of the S/MGCP Call Agent (CA) interface.

If you experiencing difficulty with any of these concepts, please see you instructor for assistance.