



# **Engage Clarity Solution Description Guide**

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# Preface

## About this manual

This guide explains the Engage Clarity overview, its high-level architecture and components, Clarity service management interfaces, Clarity deployment models, and Clarity integration call flows. Hereafter, in this document, the Engage Digital Platform (EDP) refers to the Engage Clarity Platform.

## Audience

This document is intended for the Service Provider (SP) and Platform Admin user. The SP user is responsible for integrating, hosting, and managing the Engage Clarity solution for the end user. A Platform Admin is the System Admin who installs and configures the Engage Clarity resources, sets up the Clarity Web UI, and provisions the audio clips for prompts and announcements.

## Revision History

Publication Date	Description
December 2024	Initial release.

## About Related Radisys Products

To know more about Radisys Engage Clarity solution, visit the Radisys website at [www.radisys.com](http://www.radisys.com).

## Technical Support

Technical support is available from the Radisys Technical Assistance Center (TAC). Support is governed by the terms of your agreement with Radisys Corporation.

TAC can be reached using the following contact information.

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E-mail: [tac@radisys.com](mailto:tac@radisys.com)

To access support for Engage Media Server from the Radisys webpage, go to <https://www.radisys.com/support-portal/mediaserver-applicationserver>.

## Notational Conventions

This manual uses the following conventions.

<b>BoldText</b>	A keyword.
<i>ItalicText</i>	File, function, and utility names.
<b>MonoText</b>	Screen text and syntax strings.
<b>BoldMonoText</b>	A command to enter.
<i><b>MonoText</b></i>	Variable parameters.
Brackets [ ]	Command options.
Curly braces { }	A grouped list of parameters.
Vertical line	An “OR” in the syntax. Indicates a choice of parameters.

All numbers are decimal unless otherwise stated.

## About Engage Clarity

Engage Clarity is a hearing wellness solution for Mobile Network Operators (MNOs) that improves speech intelligibility for their subscribers in voice conversations over various communication channels, such as landline, mobile (2G to 5G), SIP-based VoIP, and WebRTC clients. Users can use the Clarity solution to make regular voice or video calls, WhatsApp calls, Microsoft Teams calls, VoIP calls, and so on.

Engage Clarity is a network solution that anyone with normal to moderately severe hearing loss can use through any voice telephony device without installing any application. Engage Clarity tunes the user's audio through a clarity sound check. Based on the user's hearing ability with the current phone, the Engage Clarity solution creates a personalized audio profile for the user.

## Engage Clarity Solution for Service Providers

Conversation is the predominant method of interacting and communicating for most of the world, but a large percentage of the global population suffers from hearing loss. Hearing loss is prevalent across all age groups. According to the World Health Organization (WHO), over 1 billion young adults are at risk of permanent, avoidable hearing loss due to unsafe listening practices. Individuals with hearing loss often encounter frustration when engaging in mobile calls. Hearing loss in children can lead to many developmental challenges. This evidence is clear that a sizable population faces significant challenges in the realm of digital communication.

Service Providers (SPs) or Mobile Network Operators (MNOs) have a unique opportunity to enhance their services and generate revenue by offering Engage Clarity as a Value-Added Service (VAS). Service Providers charge a small monthly fee to subscribers who struggle to hear phone conversations, which can enable Engage Clarity and enhance their audio quality during a call in real-time. This creates substantial goodwill through a service that promotes inclusion and accessibility.

MNOs, recognizing their strategic position, have a valuable opportunity to enhance their services and contribute to the well-being and inclusiveness of a large segment of society. By offering in-call speech enhancement solutions, MNOs can play a pivotal role in fostering a more accessible, supportive, and inclusive digital landscape. Alternatively, MNOs may consider providing this capability for free, thus meeting their inclusivity goals with no one left behind.

Satisfied customers are likely to show loyalty to the service provider that empowers them with clear calls, leading to reduced subscriber churn. By proactively meeting this need, forward-thinking service providers can gain a reputational edge over competitors and be recognized as an industry leader in call quality and enhancement. The minimal costs of deploying Engage Clarity are outweighed by the revenue upside and subscriber affinity benefits of offering this much-needed phone audio enhancement capability.

Following are the key benefits of the Engage Clarity solution for an MNO or SP.

- Enhanced speech clarity and intelligibility
- Ease of integration
- Improved customer loyalty
- Increased revenue

## Engage Clarity Solution in MNO's Network

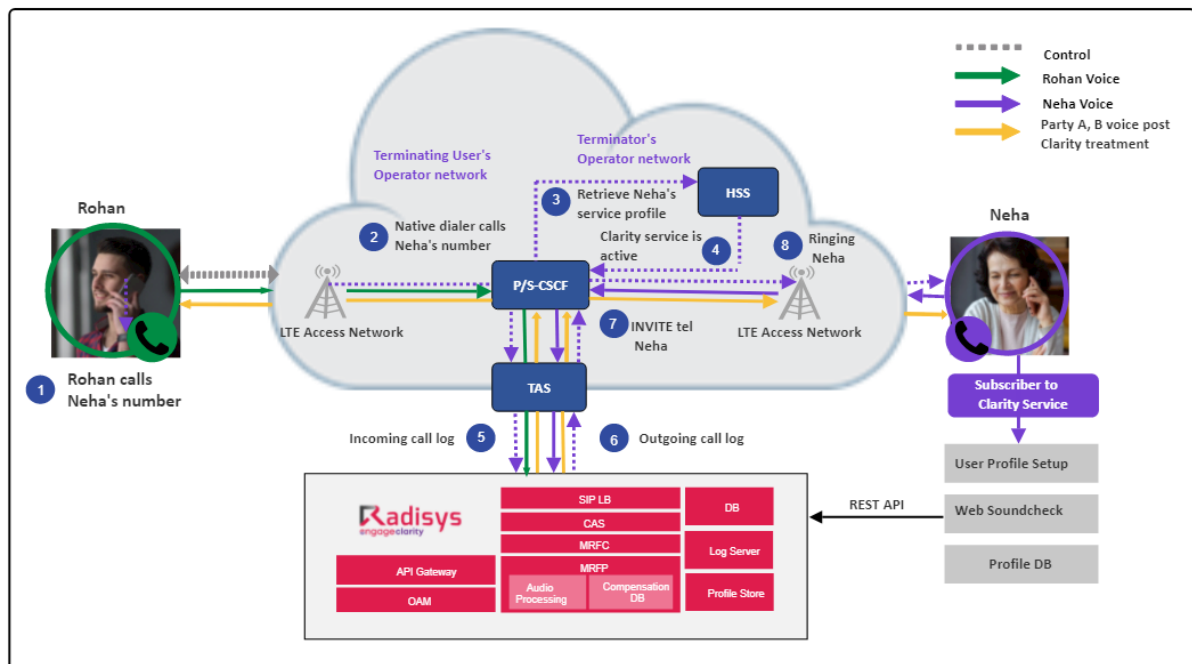
Engage Clarity is a personalized hearing improvement wellness solution that MNOs or Service Providers (SPs) can offer to their subscribers. Engage Clarity seamlessly integrates with the MNOs network, ensuring a smooth and user-friendly experience for subscribers without requiring special apps or devices or any change in behavior.

Engage Clarity is an in-network solution deployed in the MNO's network. In terms of IMS architecture, Clarity is a Value-Added Service (VAS) implemented by a dedicated SIP Application Server (AS).

### How Engage Clarity Solution Works

The following example depicts how the Engage Clarity solution works in the network for users without using any additional device or installing apps.

**Figure 1. Engage Clarity Solution**



**Step 1.** A 4G VoLTE subscriber (also known as a **Caller**) calls another 4G VoLTE subscriber (also known as a **Callee**) using their mobile phone.

**Step 2 to Step 4.** The originating IP Multimedia Subsystem (IMS) Core network checks whether the Clarity service is active for the user per subscription details obtained from the Home Subscriber Server (HSS).

The illustration above shows that the Clarity service is activated for the **Called** party.

**Step 5.** The Engage Clarity solution is inserted into the call path to enhance audio quality for the **Called** party. The Call Session Control Function (S-CSCF) routes the Session Initiation Protocol (SIP) call towards the Engage Clarity or Telephony Application Server (TAS). Engage Clarity solution supports both narrowband and wideband codecs.



When the S-CSCF or TAS routes the SIP call to Engage Clarity, it checks whether the Clarity service is activated for the Caller, Callee, or both the call legs. Engage Clarity performs SIP negotiations such that the Caller media route through Engage Clarity instead of being directly sent to the Called party.

**Step 6 to Step 8.** The Engage Clarity initiates a call towards the **Called** party, and the IMS Core network routes the call as per the **Called** party's phone number. When the **Called** party answers the call, Engage Clarity processes the audio signals for the incoming media (from the **Calling** party) per the party's Clarity hearing loss profile. This results in improved hearing user experience for the **Called** users. A similar procedure is followed for the **Calling** party if it's also an active Clarity service subscriber; otherwise, the **Calling** party receives the call without any Clarity treatment.

## Engage Clarity Solution for End-Users

To use Engage Clarity, users must subscribe to the Clarity service and create their personalized hearing profile.

To create a personalized hearing profile, subscribers only need a mobile phone, a mobile/Web browser, and five minutes of setup time. Users can access the Engage Clarity UI through the browser and perform a Clarity sound check to measure and map hearing loss over a range of high and low audio frequencies. After the hearing test is completed, the Clarity solution displays a graphical result to the user. Based on the user's hearing ability with the current phone, the Engage Clarity solution creates a personalized audio profile for the user and maps to your current phone so that you can talk to your friends and family with voice call enhancements.

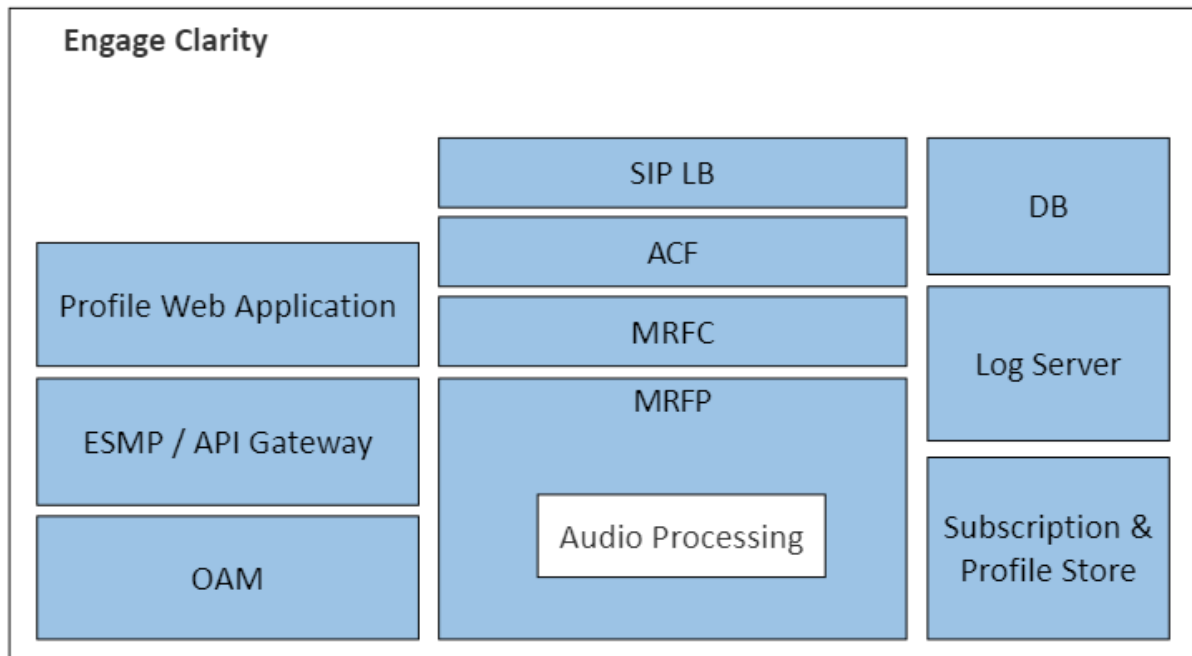
Any user already using a hearing aid or Bluetooth device can create a personalized Clarity profile with the phone's current settings. Users can create multiple hearing profiles on different phones. Each hearing profile is personalized and unique based on the calling device settings and the hearing ability of the right or left ear. These capabilities ensure that Clarity subscribers experience improved understanding and clarity in their phone conversations when they make or receive a call. This addresses a critical need for those with hearing difficulties.

For more information on subscribing to the Clarity service and creating a personalized hearing profile, refer to the *Engage Clarity User Guide*.

## Engage Clarity Architecture and Components

The following figure shows the Engage Clarity Platform architecture and its high-level components.

**Figure 2. Clarity Solution Architecture**



## Engage Clarity Components

Engage Clarity Platform has the following major components.

- [Databases \(on page 11\)](#)
- [Storage \(on page 11\)](#)
- [SIP Load Balancer \(on page 12\)](#)
- [Application Control Function \(on page 12\)](#)
- [Media Server \(on page 12\)](#)
- [Speech Adapter \(on page 12\)](#)
- [Clarity Web UI \(on page 13\)](#)
- [Clarity Subscription and Profile Store \(on page 13\)](#)
- [Operations, Administration, and Management \(on page 13\)](#)
- [Service Management Platform \(on page 13\)](#)
- [Log Server \(on page 13\)](#)
- [API Gateway \(on page 14\)](#)

## Databases

The Engage Clarity solution stores configuration and provisioning details in various databases, such as Couchbase DB and PostgreSQL DB.

### Couchbase DB

Couchbase is a NoSQL database providing high volume writes for storing Engage Clarity service configurations and other auxiliary data. It is deployed in an HA cluster mode where three Couchbase instances provide a single, distributed data store for storing Engage Clarity service-related configurations. Couchbase runs inside a Kubernetes cluster backed by GlusterFS storage.

Couchbase runs in a masterless HA mode, where each node is responsible for serving a portion of data and is backed by some other node in the cluster as its Replica. This provides the cluster with high resiliency from node failures.

### PostgreSQL DB

PostgreSQL DB (PGDB) is deployed in a High-Availability (HA) cluster mode in EDP where one master PGDB instance and two replicas provide a single, distributed data store for storing Call Detail Records (CDRs) and OAM data. PostgreSQL DB also stores tenant user details and is used as a Dashboard database. GlusterFS is the storage provider for PostgreSQL.

## Storage

EDP provides various storage options to meet the persistent storage requirements of relevant microservices in EDP. In Kubernetes deployment, the EDP microservices are provided with persistence storage to persist the data. The respective microservice would mount the same. For EDP on-premise deployment, the supported storage is GlusterFS.

### GlusterFS

GlusterFS is a scalable network file system for data-intensive tasks such as cloud storage and media streaming. There are a minimum of three deployments of the GlusterFS service in an HA cluster mode with replicated volumes.

The GlusterFS storage cluster is deployed with **Kadalu** to provide persistent storage in a container such as Kubernetes. GlusterFS also performs the following functions.

- Acknowledge Persistent Volume Claims (PVCs) from the `infra` and Couchbase DB pods.
- Dynamically provision Persistent Volumes (PVs) for all the nodes.

**Note:**

- GlusterFS storage is used only for EDP on-premise deployment.
- Kubernetes uses Kadalu API for dynamic volume creation and deletion in the `glusterfs` cluster as required by the EDP service pods.

## SIP Load Balancer

The SIP Load Balancer (SLB) is a stateful inbound and outbound proxy and load balancer for ACF. The incoming call traffic is distributed across the available ACF nodes based on the call-load distribution algorithm. The SLB chooses a less loaded ACF from the configured list of available ACF nodes that can cater to the incoming calls.

## Application Control Function

The Application Control Function (ACF) is the core component of the Engage Platform. It is a Session Initiation Protocol (SIP) Application Server (AS), which manages incoming and outgoing call setup and interfaces with the Media Server for media-related functions.

ACF is a generic enterprise Telephony Application Server (TAS) that supports various voice and video services. It acts as a SIP Third-Party Call Controller (3PCC) to establish sessions between the user's SIP endpoint and the Media Server. ACF provides SIP User Agent Client (UAC) and User Agent Server (UAS) functionalities as per RFC 3261.

## Media Server

Media Server provides carrier-grade platform designed from the outset to efficiently and cost-effectively process voice, video, and data, and to combine these into a rich, multi-service communications experience. It supports real-time media processing capabilities such as Clarity, Interactive Voice Response (IVR), Conferencing, Transcoding, Voice Quality Enhancements (VQE), and so on.

The Engage Media Server product family consists of the virtual Media Server and Containerized Decomposed Media Server. However, depending on the deployment requirement, you may opt for a Containerized Decomposed Media Server or a virtual Media Server.

## Speech Adapter

Speech Adapter is responsible for integration with third-party speech engines such as Google or Azure cognitive services. It has plugins for Google and Azure speech engines to provide STT and TTS services. Speech Adapter acts as a bridge between the Media Server and third-party speech engines. It performs necessary signaling and media adaptations.

The Speech Adapter in EDP supports the following features.

- Integration with the third-party speech engine
- Speech Recognition and Translation
- Text-to-speech announcements

The Speech Adapter is a cross-platform Media Resource Control Protocol (MRCP) implementation. The implementation encapsulates Session Initiation Protocol (SIP), Realtime Streaming Protocol (RTSP), Session Description Protocol (SDP), MRCPv2, and Real-time Transport Protocol (RTP)/RTCP stacks and provides integrators with an MRCP version consistent API.

There are a minimum of two deployments of the Speech Adapter service to prevent a single point of failure. The EDP application applies the control plane IP address configured for a specific Speech Adapter instance at the deployment time.

When a specific Speech Adapter VM goes down, Kubernetes restarts it with the same configured control and media IP addresses that were assigned before the VM failure. If a Kubernetes node fails, the kube scheduler schedules the Speech Adapter VM on the available node. If no node is available, the VM remains in a pending state, and the Speech Adapter VM configured as the secondary becomes active.

Speech Adapter VM deployment uses node affinity as the preferred scheduling policy. If multiple media-labeled nodes are present, the two instances of Speech Adapter (Speech Adapter-1 and Speech Adapter-2) are scheduled on different nodes.

## Clarity Web UI

The Engage Clarity solution uses a Web UI to create and manage hearing profiles. Clarity subscribers can perform hearing tests and create personalized hearing profiles.

## Clarity Subscription and Profile Store

The Engage Clarity subscription and profile data is stored here.

## Operations, Administration, and Management

The OAM is a Web-based management component in EDP, which supports Configuration Management (CM), Performance Management (PM), Fault Management (FM), User Account Management, Log Management, and maintenance functions for the EDP. The OAM integrates with Kubernetes to provide application and node monitoring functionality.

## Service Management Platform

The Engage Service Manage Platform (ESMP) is a common service management multi-tenancy platform for Engage applications and services. ESMP provides a self-care portal for the Service Partners (SP) and Service Owners (SO).

## Log Server

EDP uses the cluster-level logging architecture based on the Elasticsearch, Fluentd, and Kibana (EFK) stack. All the EDP components write the logs to the standard output and standard error streams. These pods collect the logs from each Kubernetes node, append applicable metadata fields to logs, such as the pod name and namespace, transform them as JSON data, and output them to the ElasticSearch database. The EDP components also support setting different log levels in application logs, such as ERROR, INFO, WARN, DEBUG, and TRACE.

## API Gateway

API Gateway is an API management tool that acts as a proxy between any API client and the backend services. It secures, protects, manages, and scales API calls by intercepting the requests and applying policies such as security and throttling before passing the incoming API requests to the configured backend endpoints.

## Engage Clarity Requirements

This section describes the system requirements (including hardware and software requirements) for the Engage Clarity Platform deployment. For more information, refer to the *Engage Clarity Installation Guide*.

## Engage Clarity for Service Management

The Engage Clarity service has subscription and activation states.

- **Subscribed.** The **Subscribed** state indicates that the user has subscribed or registered to the Clarity service and has provided necessary details such as terms and conditions, service usage guidelines, and so on. The supported values are Subscribed and Not Subscribed.
- **Activation.** The **Activation** state indicates that the Clarity service is active and will take effect when dialing or receiving a call. To activate, the user must complete the hearing test and subscribe to the Clarity service. The supported states are Active and Not Active.

**Figure 3. Clarity Subscription and Activation States**

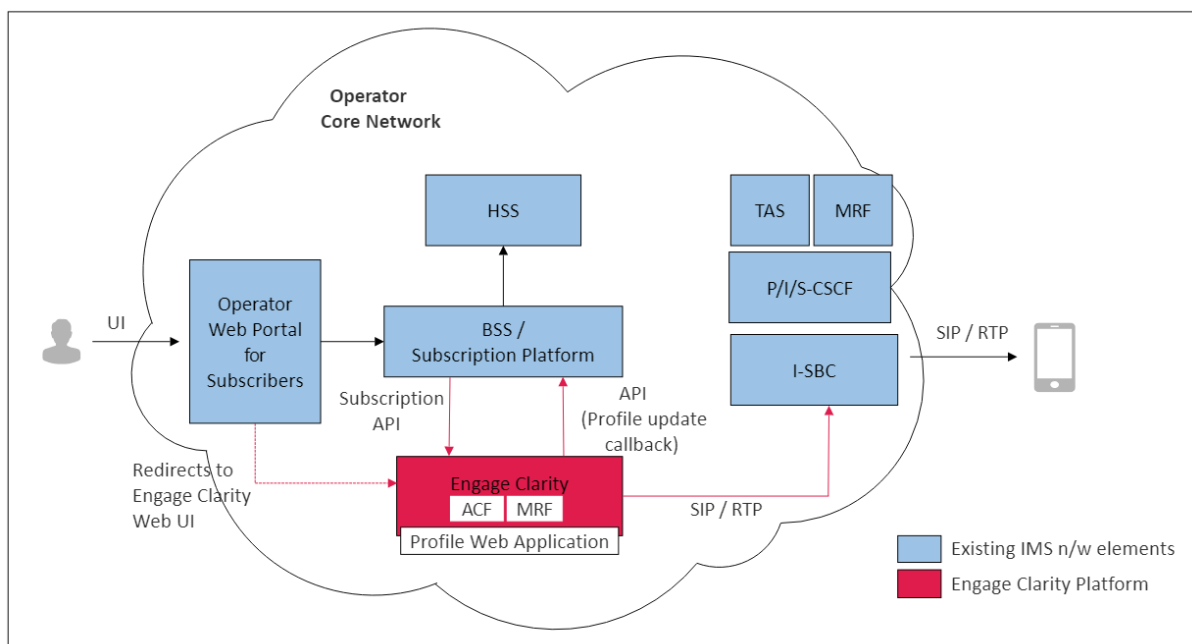


**Note:** The above mentioned states are for illustrative purposes only and may differ based on the different deployment scenarios in the Telco Service Provider's (SP) network.

## Engage Clarity Service Management Interfaces

The Engage Clarity Platform supports the following service management integration interfaces.

**Figure 4. Clarity Service Management Interfaces**



The following table specifies the interfaces between the operator's network and the Engage Clarity platform.

**Table 1. Clarity Service Management Interfaces**

Interface Name	Direction	Protocols Used	Interface Provided by	Description
Interface 1: <b>Subscription</b>	BSS/Subscription Platform -> Engage Clarity	HTTPS/API	Engage Clarity	The <b>Subscription</b> interface (through Subscription APIs) is used by the Business Support Systems (BSS) or subscription platform. When a Clarity service subscription is newly created or modified in the Home Subscriber Server (HSS), it sends a Subscription APIs request to the Engage Clarity Platform.
Interface 2: <b>Profile Web UI</b>	Operator Web portal -> Engage Clarity	HTTPS	Engage Clarity	The <b>Profile Web UI</b> interface is used between the Operator's customer-facing Web portal and Engage Clarity Profile Web UI. This is achieved using a simple HTTP redirection or deeper integration through Single Sign-on (SSO).
Interface 3: <b>A2P Calling</b>	Engage Clarity -> SBC/SIP Trunk	SIP/RTP	Operator Network	Engage Clarity uses a SIP trunk-based interface with the operator network to initiate calls to Clarity subscribers. This is called the outbound <b>Application-to-Person (A2P) Calling</b> interface. This Clarity call aims to perform a sound test and create a personalized hearing profile for the Clarity subscriber.
Interface 4: <b>Activation</b>	Engage Clarity -> BSS/Subscription Platform	HTTPS/API	BSS/Subscription Platform	Clarity subscribers can create personalized hearing profiles on the Engage Clarity platform, which requires an <b>Activation</b> interface to update their profile status.

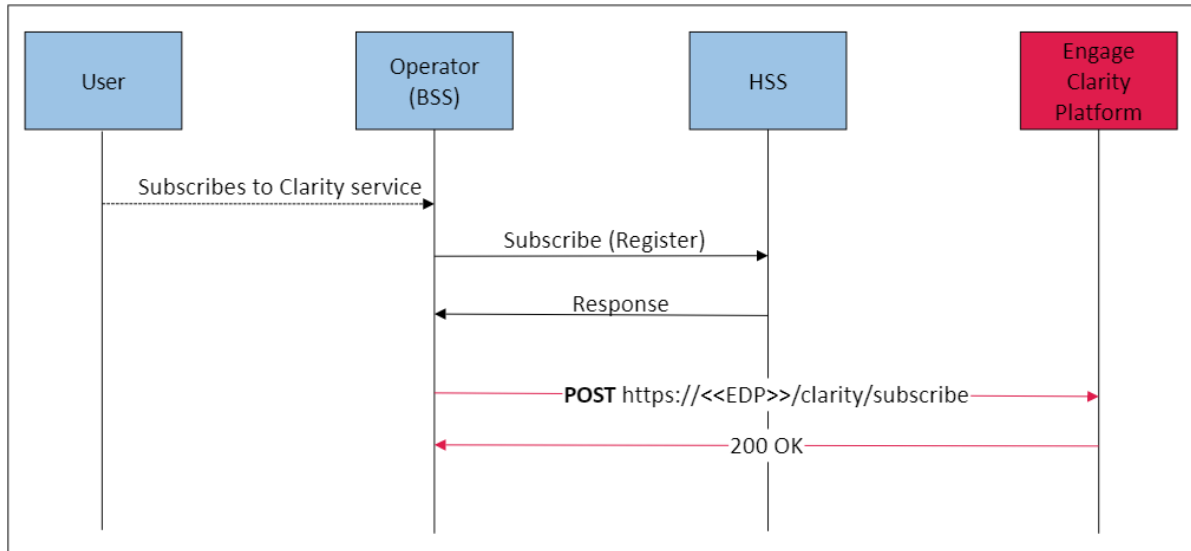
## Clarity Subscription Interface

To subscribe to the Clarity service for end users, the Telco Service Providers can provide an interface (either Service Provider's self-care Web portal, mobile app, or other channels) that is accessible to the Contact Centre (CC) or Point of Sale (POS).



The Clarity service subscription status is stored in the HSS and must be informed to the Engage Clarity platform. Based on the subscription status, users can undergo sound tests and create their personalized hearing profiles.

For more information, refer to the following call flow diagram.



### Subscription Data Store in HSS

The Service Provider manages the Clarity service subscription. The Service Provider HSS stores the following details for their Clarity subscribers.

- **Subscription Status.** Specifies the Clarity service subscription status.
- **Activation Status.** Specifies whether the Clarity service is **Active** or **Inactive**.

### Initial Filter Criteria (IFC) in HSS

To support Clarity service in IMS, the Engage Clarity Platform acts as an SIP Application Server (AS), which differs from standard Multimedia Telephony (MMTel) AS. The Engage Clarity Platform implements the signaling and media processing specific to realizing the Clarity service. The Initial Filter Criteria (IFC) trigger point must be updated for active Clarity service users so that the S-Call Session Control Function (S-CSCF) inserts the Engage Clarity platform.

### BSS/Subscription Platform

The Service Provider can manage the Clarity service through their self-care Web portal or service provisioning application. The Clarity Web UI (used for hearing tests) must be integrated with the Service Provider's self-care Web portal.

## Clarity Web UI Interface

The Engage Clarity solution provides a Web UI interface for users to create and manage their unique hearing profiles. The Service Provider can integrate the Clarity Web UI into their self-care portal and share

the details with their users. For example, after subscribing to the Clarity service, users can create their hearing profiles through SMS, IVR, or by visiting the self-care portal.

The Engage Clarity Web UI is a lightweight Web application that can be integrated into the Service Provider's self-care Web portal using the following options.

- [Clarity Subscription APIs \(on page 18\)](#)
- [Single Sign On \(SSO\) \(on page 18\)](#)
- [OTP-based Login \(on page 18\)](#)
- [Iframe \(on page 18\)](#)

## Clarity Subscription APIs

The Clarity Subscription APIs are used to get, create, update, and delete the Clarity subscriptions. For more information on Engage Clarity Profile and Subscription APIs, refer to the *EDP Applications User and Developer Guide*.

## Single Sign On (SSO)

The Clarity Web UI supports Single Sign-on (SSO) to integrate with the Service Provider's self-care portal. The SSO supports standards protocols such as Security Assertion Markup Language (SAML) or OAuth2.0. The users can log in to the Service Provider's self-care portal and authenticate themselves. After login, the user is redirected to the Clarity Web UI. For SSO access, the user must use the same number that is registered with the Service Provider for the Clarity service.

## OTP-based Login

Engage Clarity Web UI can be deployed as an independent application. The Service Provider's self-care portal can display as a **Click** button to create a personalized hearing profile. The Clarity Web UI page opens in a new tab when the user clicks the button. To access Clarity Web UI, user can input their registered phone numbers and authenticate through an SMS or Voice OTP.

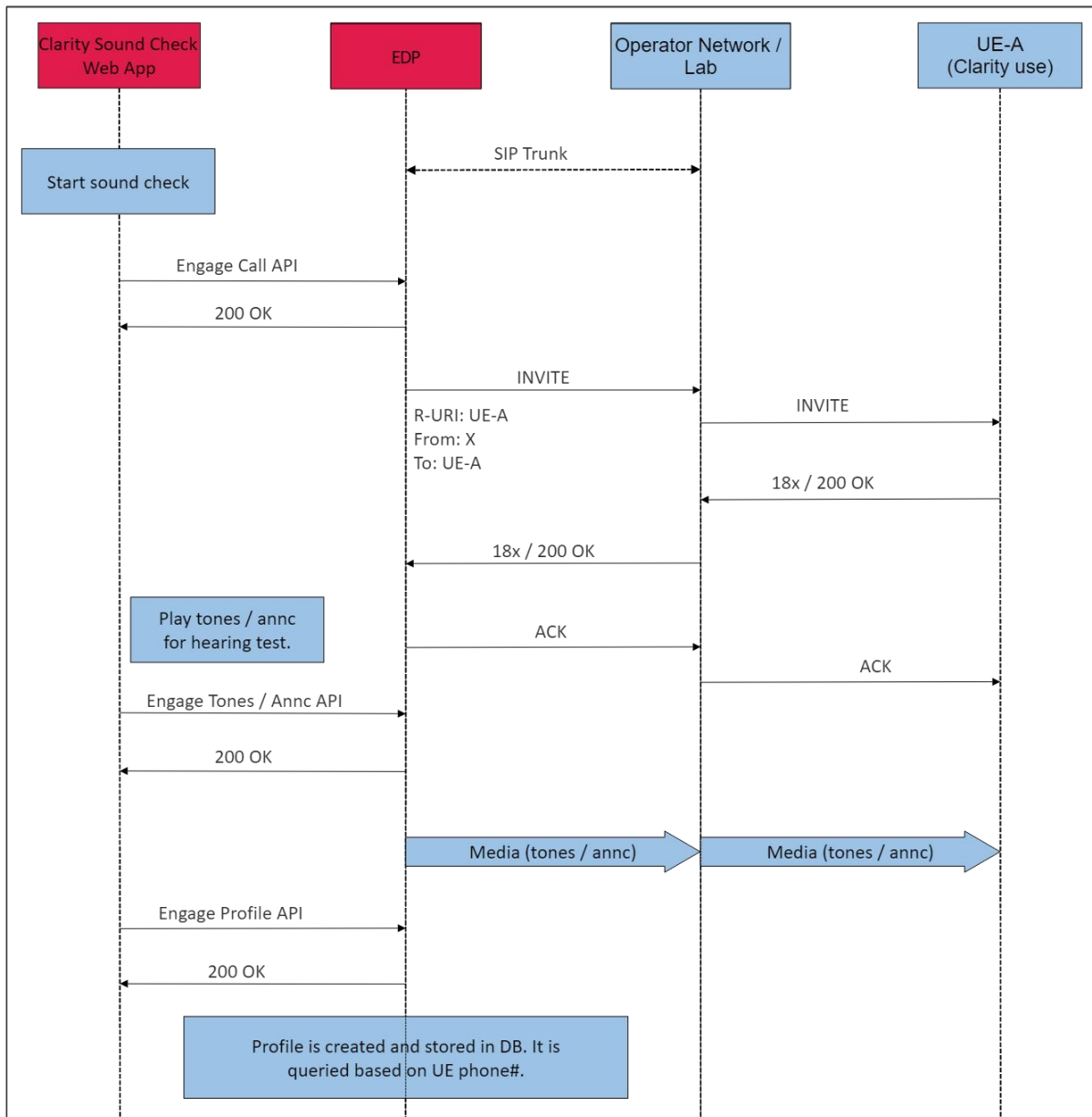
## Iframe

Engage Clarity Web UI can be integrated into the Service Provider's self-care Web portal using an Iframe/Inline Frame (an HTML element embedded inside an HTML page). The user's registered phone number is used to redirect the request to Engage Clarity.

## Outbound A2P Calling Interface

After subscribing to the Clarity service, users can create their unique hearing profiles through Clarity Web UI. During the hearing profile creation, Engage Clarity Platform makes an outbound call to the user's registered phone number. The Engage Clarity Platform requires a SIP trunk-based interface or integration with the Service Provider's Interconnect Session Border Controller (I-SBC).

Following is the sample outbound call flow of basic SIP-based interface.

**Figure 5. Outbound Call Flow from Engage Clarity**


## I-SBC for Outbound Calling

This is the profile creation calling interface. Engage Clarity Platform acts as an application, so this interface is called an outbound A2P calling interface. Engage Clarity Platform integrates with Service Provider Interconnect Session Border Controller (I-SBC) using SIP/RTP protocol. It requires a virtual number (“X”) to be set in the “From” header of an outgoing INVITE request (see above in the diagram). Clarity subscribers will see this number as the calling party.

The Engage Clarity Platform supports a SIP RFC 3261-based outbound call flow (as shown in the figure above) but does not support SIP registration. This interface supports only the outgoing interface (*Engage Clarity Platform -> Service Provider's network -> UE*).

Once the outbound call is established with the user's phone, the Engage Clarity plays the prompts and announcement tones to complete the hearing test. The user provides hearing feedback through the Clarity Web UI. The Clarity Web UI interface does not require any DTMF-based input.

## Avoid IFC based chaining

The profile creation outbound A2P call is initiated for the hearing test. Assuming a user has a profile created already and is trying to modify it, Engage Clarity initiates a mobile termination call towards this user's phone. The S-CSCF (terminating) may try to insert Engage Clarity in the call path based on the Initial Filter Criteria (IFC) rule. This is an undesired situation and needs to be avoided.

The Engage Clarity includes a custom SIP header parameter `X-Clarity-Exclusion` and set value as **true** in the outgoing call to I-SBC. This is to differentiate between profile creation call and regular calls. The I-SBC pass-through this parameter to CSCF. The IFC criteria must be defined to exclude chaining of Engage Clarity when `X-Clarity-Exclusion` parameter is present with value "true".

Engage Clarity includes a custom SIP header parameter `X-Clarity-Exclusion` and sets the value to **true** in the outgoing call towards I-SBC. This differentiates between the Clarity profile creation call and regular outbound call. The I-SBC passes through the parameter `X-Clarity-Exclusion` to CSCF. The IFC criteria must be defined to exclude chaining of Engage Clarity when the `X-Clarity-Exclusion` parameter is present with the value as **true**.

## Clarity Service Activation Interface

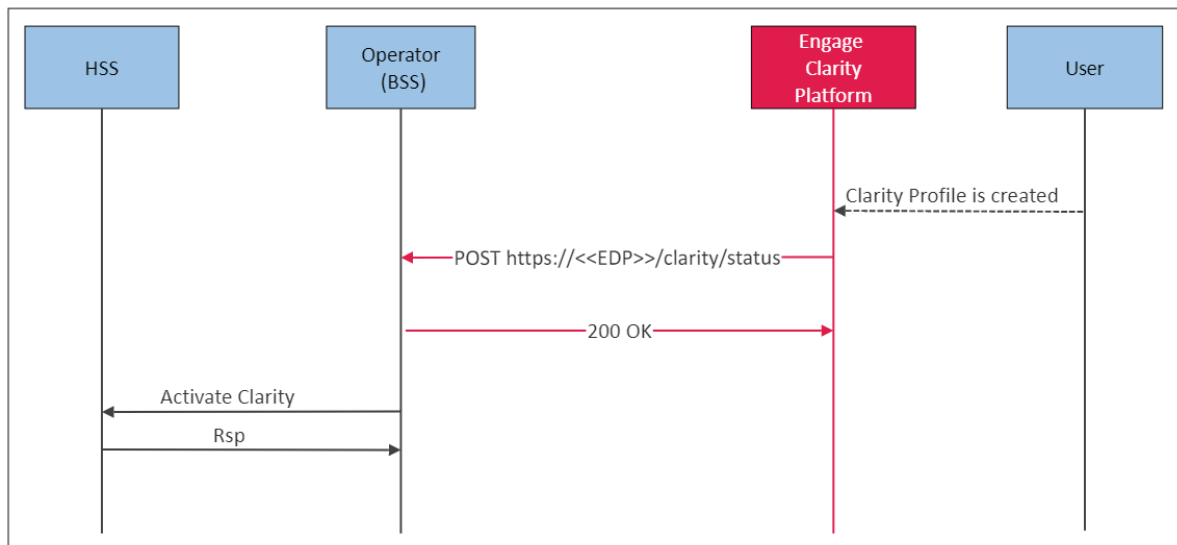
After creating the unique hearing profile, the Clarity service state is set to **Active**, and the HSS updates this change in the service state. Once the Clarity service is activated, the incoming and outgoing calls undergo a profile-based media enhancement through the Engage Clarity platform.



**Note:** Engage Clarity does not support the Sh (Diameter) interface to update HSS directly. It requires an API or callback-based interface from the BSS or subscription platform.

Following is the sample Clarity activation call flow.

**Figure 6. Clarity Profile Status Update**



## Engage Clarity in Calling Services

The Engage Clarity solution can be deployed in the MNO's network using the following deployment models. These integration options are available for two-party calling services.

- Deploy Engage Clarity as a **SIP Application Server** in the IMS network.

This is the default deployment model for Engage Clarity. In this deployment model, the Engage Clarity Platform is used for both outbound (A2P) and two-party calling services.

- Upgrade existing IMS network (MMTel and Engage Media Server) to support Engage Clarity.

This deployment model is beneficial if you are an existing Radisys customer and have already deployed the Engage Media Server in the IMS network. In this deployment model, the MMTel AS and Engage Media Server must be upgraded to support Engage Clarity. This implementation includes SIP and MSML interface enhancements in the MMTel component.

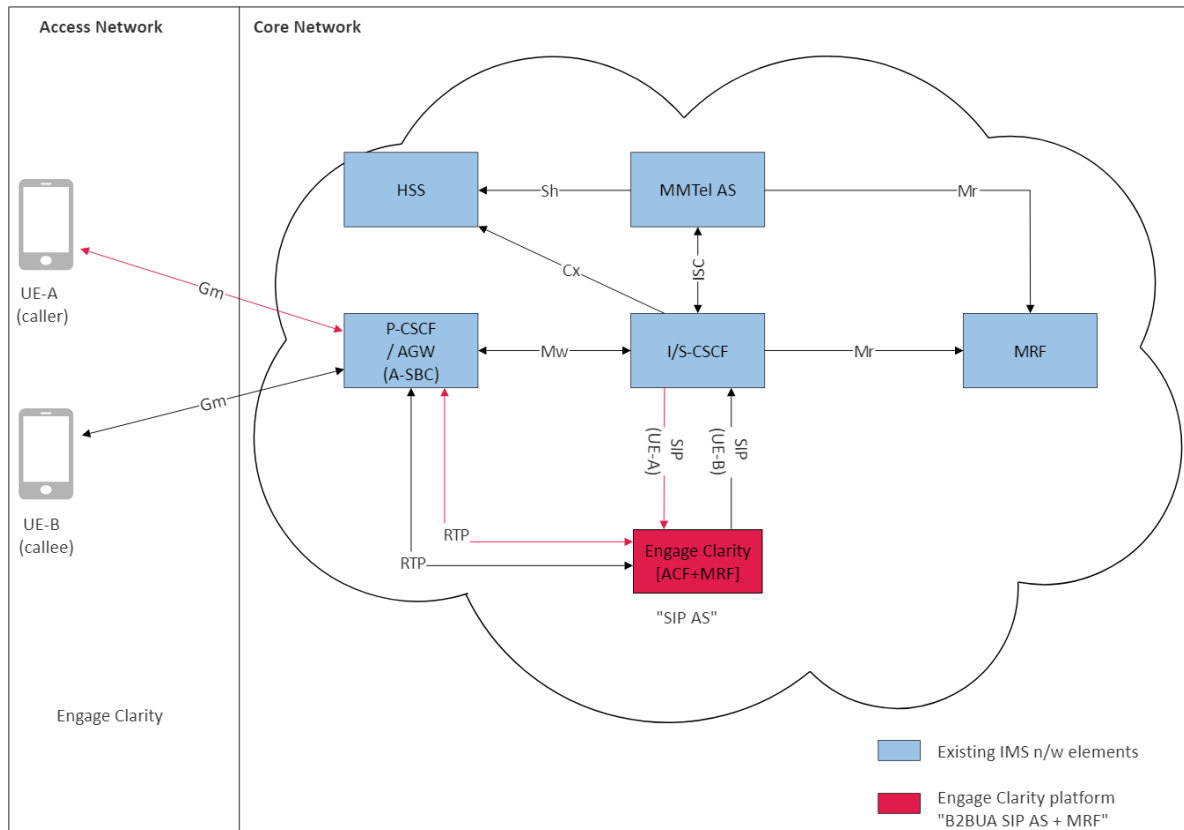
## Deploy Engage Clarity Serving as SIP Application Server

The IMS network supports multiple SIP Application Servers (AS) that perform specific feature or service realization. For example, MMTel AS is used for multimedia supplementary services. Similarly, Conference AS, Voice Mail AS, and Video Ringback Tone AS (VRBT AS) are used for respective conference, voice mail, and video ringback tone services.

## Engage Clarity Integration with S-CSCF

Engage Clarity integrates with Serving-Call Session Control Function (S-CSCF) over the IMS Service Control (ISC) interface. However, Engage Clarity supports the ISC interface only to realize the specific Clarity call flows.

Figure 7. 2-Party Calling



Following are the key points of the ISC interface between S-CSCF and Engage Clarity.



**Note:** In this section, the Caller is referred to as UE-A, and the Callee is referred to as UE-B.

- Engage Clarity has two significant components: Engage Application Control Function (ACF) and Engage Media Server.
  - Engage ACF serves as a Back-to-Back User Agent (B2BUA) and SIP Application Server for Clarity call flows.
  - The Media Server is the core media component that supports media processing, transcoding, Clarity profile-based media enhancements, and so on. Engage Media Server is controlled by Engage ACF.
- Engage Clarity solution is inserted into the IMS call signaling and media path based on the IFC rule. For example, if a Clarity subscriber UE-A (that is, Caller) calls UE-B (that is, Callee), the S-CSCF serving for UE-A checks the UE-A's subscription profile and inserts Engage Clarity in the call path accordingly.

The IFC rules are set per subscriber and stored in the respective HSS. When the UE-A subscribes to the Clarity service, the IFC rules for UE-A are updated to include Engage Clarity treatment in the call path. This standard IMS behavior includes specific AS based on user subscription needs.

- The Engage Clarity service anchors the UE-A and UE-B media on the Engage Clarity platform and undergoes Clarity-based media enhancements for voice and video calls.

The UE-A incoming SDP is negotiated with Engage Media Server. Engage ACF makes a new call offer towards UE-B using Engage Media Server SDP as an offer so that both UEs' media can be anchored locally in the Engage Media Server.

- Engage Clarity solution has a Clarity subscription and profile database. Upon receiving the SIP INVITE from S-CSCF, the Engage ACF checks whether the Caller (**From** header) or Callee (**To** header) has subscribed to the Clarity service. Based on the profile leg, the respective user call leg (either Caller, Callee, or both) undergoes Clarity-based media enhancements.

## IFC-based insertion for Engage Clarity

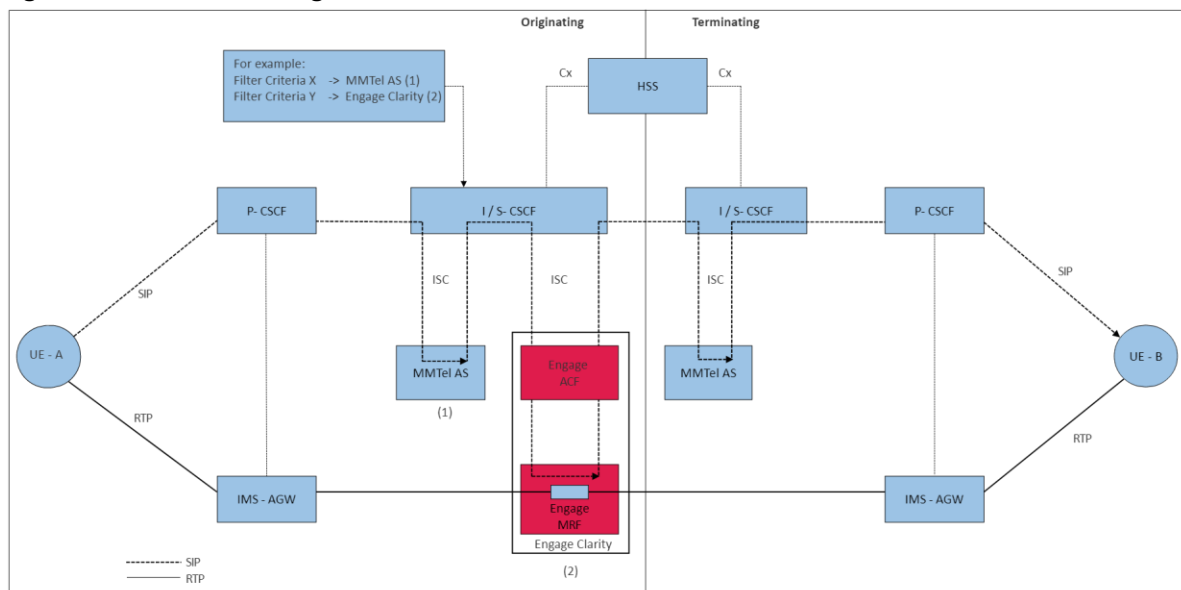


**Note:** In this section, the Caller is referred to as UE-A, and the Callee is referred to as UE-B.

In this example (see figure below), UE-A (that is, Caller) is an active Clarity subscriber, and the Initial Filter Criteria (iFC) rule is updated for UE-A to insert Engage Clarity.

IFC is a mechanism, the IMS network uses to invoke Application Servers for Session Initiation Protocol (SIP) initial requests. The MMTel AS is inserted before Engage Clarity so that MMTel AS can perform originating (or terminating) service checks as usual.

**Figure 8. iFC Based Chaining**



## Avoid Double Insert of Engage Clarity



**Note:** In this section, the Caller is referred to as UE-A, and the Callee is referred to as UE-B.

Consider the case where UE-A (that is, Caller) and UE-B (that is, Callee) are active clarity subscribers in the same network.



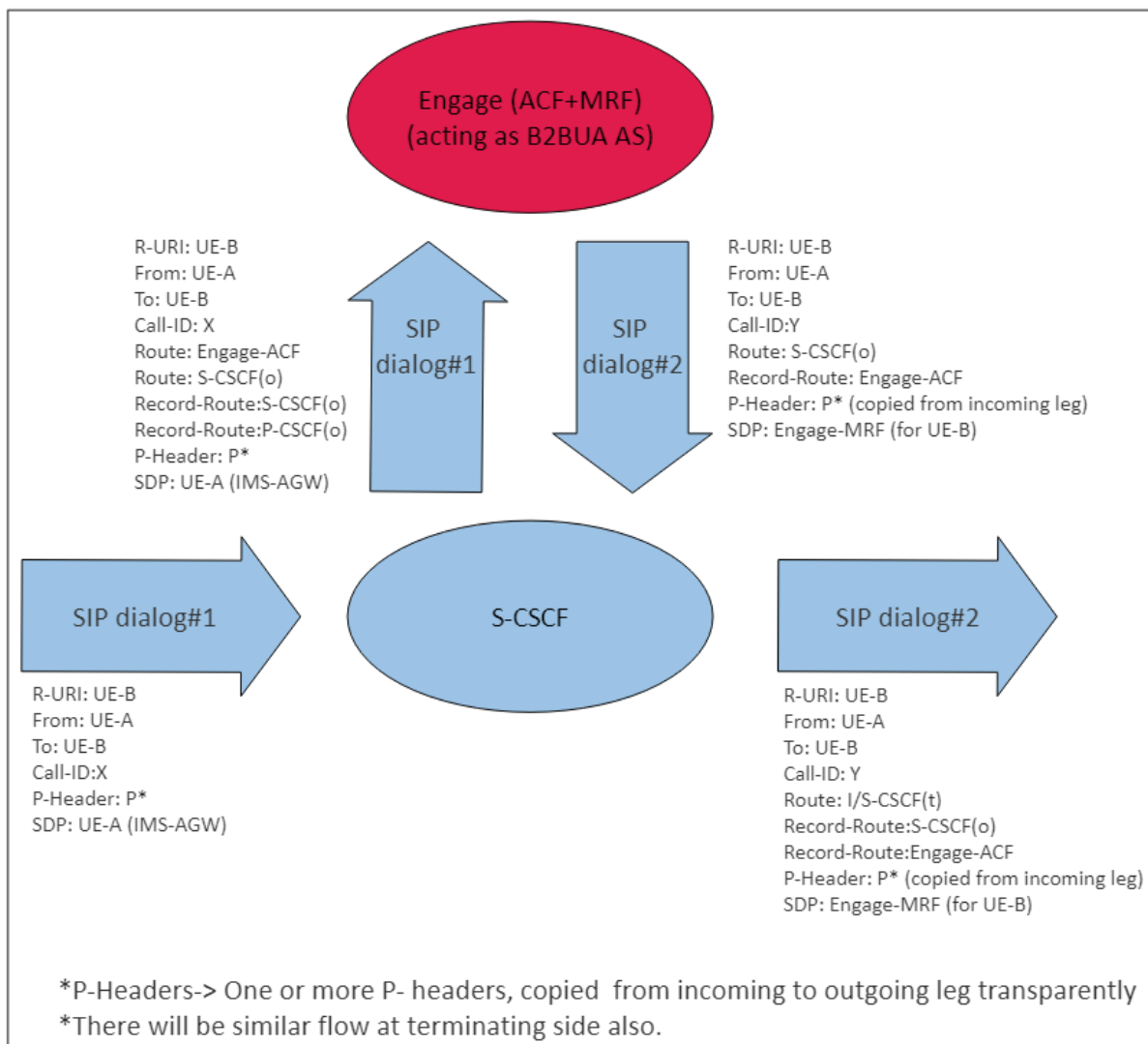
Engage Clarity is inserted twice based on UE-A and UE-B iFC rule. This is a waste of media processing resources and must be avoided. Engage Clarity is inserted at the originating side based on the iFC evaluation of UE-A. When this SIP call is received in Engage Clarity, it default checks the Clarity profile availability for both UEs. If a Clarity profile is found for both UEs, it is applied on the respective call legs. So, there is no need to insert Engage Clarity again for UE-B at the terminating side.

The Engage Platform includes a custom SIP header parameter `X-Clarity-Exclusion` and sets the value to **true** in outgoing calls towards UE-B. This custom parameter indicates that Engage Clarity insertion is excluded based on its presence and avoids double insertion of Engage Clarity. This rule must be defined in the IFC criteria.

## Engage Clarity SIP Dialogs with S-CSCF

Engage Clarity serves as an SIP B2BUA Application Server (*see figure below*) with two SIP dialogs. SIP dialog-1 is the incoming call leg, whereas SIP dialog-2 is the new call origination from Engage Clarity towards UE-B.

**Figure 9. Engage Clarity as SIP B2BUA AS**



- S-CSCF keeps the Request URI state (that is, *loose routing*) unchanged, while sending the SIP INVITE request to the Engage Clarity Platform.
- The **From** and **To** headers in the SIP INVITE request must be the Caller and Callee numbers. The Clarity profile is created using the same phone number. Engage Clarity uses the phone number specified in the **From** and **To** header to fetch the Clarity subscription details.
- The SIP request and response routing follow the **Route**, **Record-Route**, and **Via** headers.
- Engage Clarity copies all the incoming **P-\*** headers from the incoming side to the outgoing call leg.
- Engage Clarity intercepts Session Description Protocol (SDP) and negotiates the incoming and outgoing leg using the Engage Media Server.

The following figure shows an illustrative SIP call flow between UE-A (that is, Caller) and UE-B (that is, Callee).

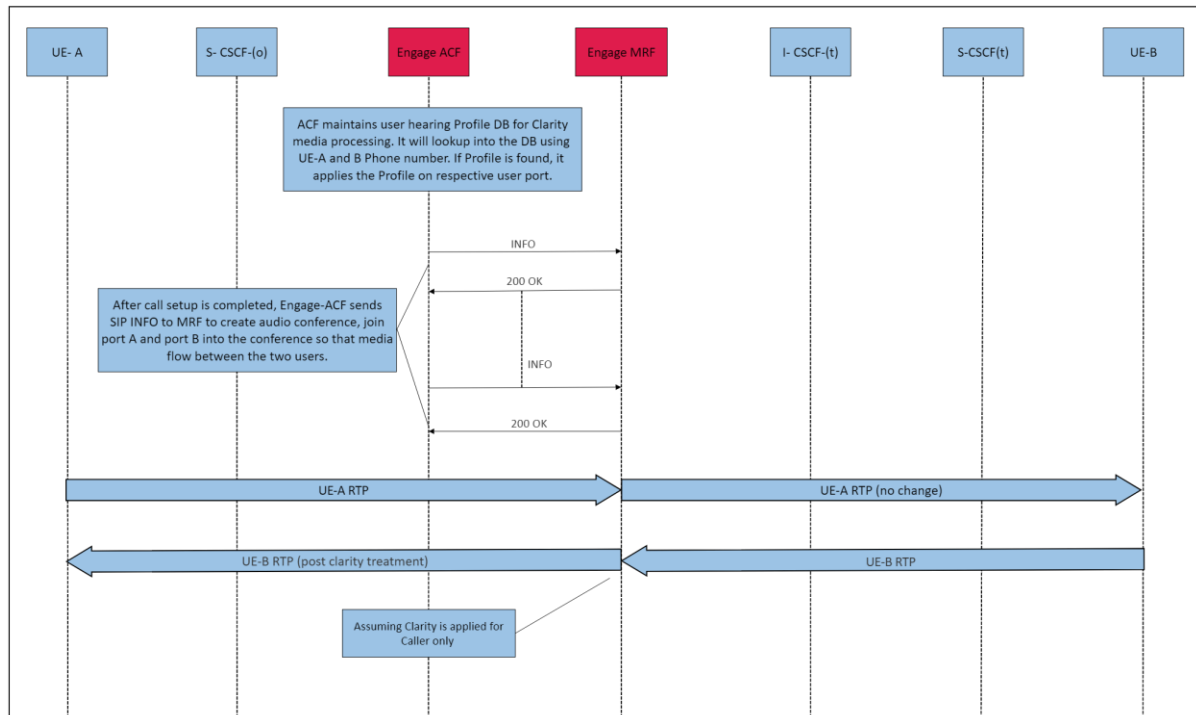
```

sequenceDiagram
    participant UA as UE-A
    participant So as S-CSCF(o)
    participant EACF as Engage ACF
    participant EMRF as Engage MRF
    participant It as I-CSCF(t)
    participant St as S-CSCF(t)
    participant UB as UE-B

    UA->>So: INVITE (SDP A)  
R-URI: UE-B
    So->>EACF: INVITE (SDP A)
    EACF->>EMRF: INVITE (no SDP)
    Note over EMRF: [Create port to anchor UE-B media, use this SDP to make call to UE-B]
    EMRF->>EACF: 200 OK (SDP MS-B)
    EACF->>So: INVITE (SDP MS-B)
    So->>It: INVITE (SDP MS-B)
    It->>St: INVITE (SDP MS-B)
    St->>UB: INVITE (SDP MS-B)
    UB->>St: 18x
    St->>It: 18x
    It->>So: 18x
    So->>EACF: 18x
    EACF->>EMRF: 200 (SDP B)
    EMRF->>EACF: ACK (SDP B)
    EACF->>So: 200 OK (SDP B)
    So->>UA: 200 OK (SDP MS-A)
    UA->>So: ACK
    So->>EACF: ACK
    EACF->>EMRF: INVITE (SDP A)
    Note over EMRF: [Create Port to anchor UE-A media, answer UE-A call with Engage-MRF SDP]
    EMRF->>EACF: 200 OK (SDP MS-A)
    EACF->>So: ACK
    So->>It: ACK
    It->>St: ACK
    St->>UB: ACK
  
```

The following figure shows an illustrative MSML call flow between UE-A (that is, Caller) and UE-B (that is, Callee).

Figure 11. MSML Call Flow in a Two-Party Call



## Codec Negotiations for Clarity

The codec negotiation for a Clarity subscriber can occur during the initial call setup or a mid-call.

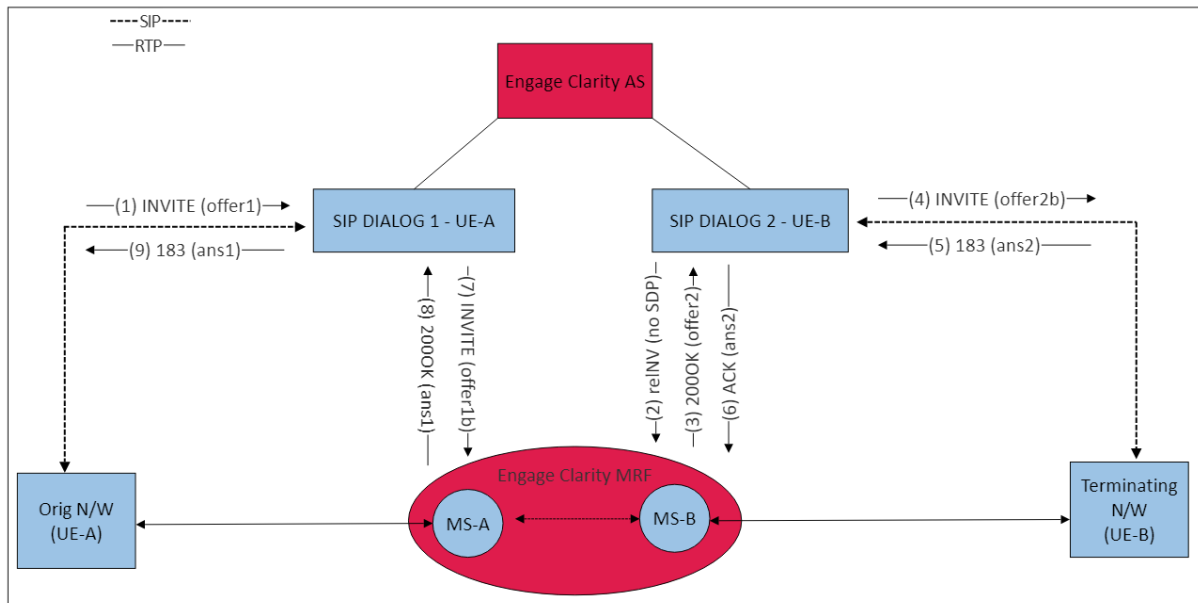


### Note:

- Some integration call flows related to mid-call changes and codec bypass may not be supported in the current Engage Clarity release. However, they will be supported in upcoming releases.
- In this section, the Caller is referred to as UE-A, and the Callee is referred to as UE-B.

## During the Initial Call

Engage Clarity negotiates the codec on the UE-A (that is, Caller) and UE-B's (that is, Callee's) leg, as shown in the figure below. It attempts to ensure that the same codec is locked down between UE-A and UE-B, thereby increasing the possibility of media bypass wherever possible. Engage Clarity performs transcoding the outgoing media to the Clarity subscriber. The Media Server component in Engage Clarity decodes the incoming Real-time Transport Protocol (RTP) packets, enhances the audio as per the Clarity profile, and encodes them back. However, the media going towards non-Clarity users is sent without audio enhancement, assuming a codec match.

**Figure 12. Initial Call Setup**


In the above sample example, the codecs supported by UE-A, UE-B, and Engage Clarity Media Server are as follows.

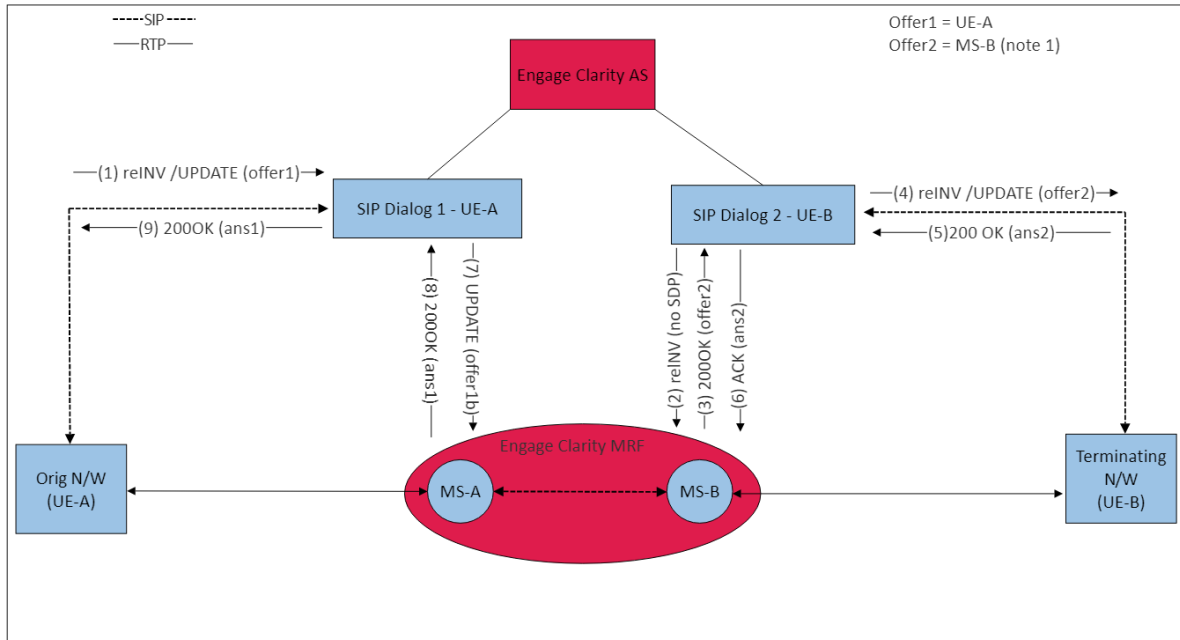
- **UE-A.** Codec1, Codec2, and Codec3
- **Engage Clarity Media Server.** Codec1, Codec2, Codec3, and Codec4
- **UE-B.** Codec2, Codec3, and Codec5

1. The UE-A (that is, Caller) sends a SIP INVITE with an SDP offer including codecs (Codec1, Codec2, and Codec3) as Offer1.
2. Engage Clarity Application Server (AS) prepares the SDP offer to be sent to UE-B (that is, Callee). It sends the SIP INVITE (without SDP) to the Media Server to create the offer SDP.
3. Engage Media Server responds with an Offer2. In this example, Offer2 includes codecs as Codec1, Codec2, Codec3, and Codec4.
4. Engage Clarity prepares Offer2b, which lists only the common codecs between UE-A and Media Server. The Offer2b lists only Codec1, Codec2, and Codec3.
5. UE-B negotiates with Offer2b and responds with an answer to lock down Codec2. This is because UE-B does not support Codec1, and the next supported codec in the incoming offer is Codec2.
6. Engage Clarity AS sets the Codec2 from ans2 on the port created for UE-B (Media Server-B).
7. Engage Clarity AS modifies the incoming Offer1 to Offer1b. The Offer1b contains only Codec2, which ensures that Engage Media Server is forced to lock down the Codec2. In some cases, the Media Server-A might have already been created. In this case, Engage Clarity AS sends a SIP UPDATE request to modify the codec.
  - Engage Media Server responds with ans1 containing Codec2.
  - Engage Clarity AS sends answer SDP to UE-A.

## During the Mid-call UPDATE or reINVITE

During the mid-call, either side (Caller or Callee) sends a SIP UPDATE or re-INVITE request to modify the codec and session parameters. In this case, Engage Clarity negotiates the same codec on both call legs.

**Figure 13. Mid-Call Codec Negotiation**



## Signaling and Media Interfaces Support

The SIP interface between Serving Call Session Control Function (S-CSCF) and Engage Clarity as follows.

**Table 2. SIP Signaling Interface Support**

Signaling Features	Supported by Clarity
SIP UDP/SIP TCP	Yes
IPv4	Yes
IPv6	Available on request
Dual-Stack (IPv4 + IPv6)	Available on request
Early Media support (100rel/PRACK/UPDATE)	Yes
SIP Preconditions support	Yes

## Media Interface Support

The media interface between IMS Application Level Gateway (IMS-AGW) or Access Session Border Controller (A-SBC) and Engage Clarity as follows.

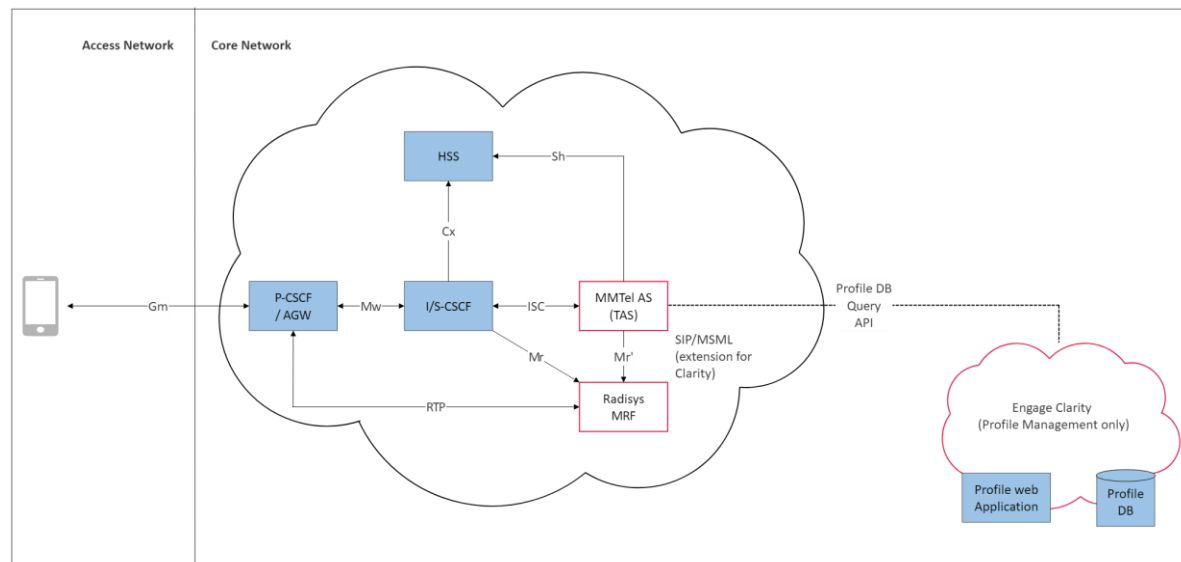
**Table 3. Media Interface Support**

Media Features	Supported by Clarity
RTP/UDP	Yes
IPv4	Yes
IPv6	Available on request
Dual-stack (IPv4 + IPv6)	Available on request
Supported Codecs	AMR, AMR-WB, EVS, G.711 (a/μ-law), G.722, and G.729

## Upgrade MMTel AS and Media Server to Support Engage Clarity

If you are an existing RadisyS customer and have already deployed the Engage Media Server in the IMS network, you can upgrade the MMTel AS and Media Server to support Engage Clarity. In this deployment model, Engage Clarity is used for hearing profile creation only.

Suppose you are an existing RadisyS customer and have already deployed the Engage Media Server in the IMS network. In this case, you can upgrade the Application Server (AS) and Media Server components to extend support for Engage Clarity.

**Figure 14. Upgrade Existing AS and Media Server for Clarity**


**Note:** In this deployment model, Service Providers can deploy Engage Clarity for hearing tests, create Clarity profiles, and integrate Clarity solution into their IMS call flows. However, Engage Clarity does not support two-party calls between users.

## MMTel AS

Service Providers can implement the Clarity solution on their existing MMTel AS/TAS and extend it as a new TAS service. This requires extending the MMTel AS/TAS to support Clarity-specific call flow, as shown above.

## Media Server

To support Engage Clarity, Service Providers can upgrade the Clarity software on their existing Radisys Media Server. The Clarity software also needs to be implemented on the MMTel AS/TAS.

**SIP/MSML port creation.** When creating a SIP or Media Server Markup Language (MSML) port in Media Server through a SIP INVITE request, the SIP AS/TAS must specify the Clarity profile parameters in the *Request-URI*.

## MSML Interface

When an SIP INVITE request is received with Clarity profile parameters in the *Request-URI*, the Media Server creates an SIP or MSML port with the following service context.

```
sip:msml@hostport;
collocate_conf=conf-name[\"/audio\" | \"/video\"];collocate_method=<option>;
fax=BOOL;cpa_dialog=dialog-name;cpa_template=index-number;pps=<a list of
FQSN>;video_pps=<a list of FQSN>;nb_init=[1|0];nb_codec=[\"amr\"|\"g711\"]; nb_amr_mode=<a
list of
modes>;jitter_template=index-number;clearmode=<option> ;clarity=[1|0];vol_adj=Y;insert_
gain=<G1>_<G2>_<G3>_<G
4>_<G5>_<G6>;comp_ratio=<C1>_<C2>_<C3>_<C4>_<C5>_<C6>;
```

```
sip:msml@hostport;
collocate_conf=conf-name[\"/audio\" | \"/video\"];collocate_method=<option>;
fax=BOOL;cpa_dialog=dialog-name;cpa_template=index-number;pps=<a list of
FQSN>;video_pps=<a list of FQSN>;nb_init=[1|0];nb_codec=[\"amr\"|\"g711\"]; nb_amr_mode=<a
list of
modes>;jitter_template=index-number;clearmode=<option> ;clarity=[1|0];vol_adj=Y;insert_
gain=<G1>_<G2>_<G3>_<G
4>_<G5>_<G6>;comp_ratio=<C1>_<C2>_<C3>_<C4>_<C5>_<C6>;
```

where the Clarity profile parameters and arguments are as follows:

clarity	<p>Optional. Enables or disables the Clarity feature.</p> <p>The supported values are:</p> <ul style="list-style-type: none"> <li>• <b>1.</b> Enables the Clarity feature. If the <code>clarity</code> parameter is set to 1 and profile parameters are present in the <i>SIP Request-URI</i>, the Media Server activates Clarity enhancement at the start of the session.</li> <li>• <b>0.</b> Disables the Clarity feature. If the <code>clarity</code> parameter is set to 0 and profile parameters are present in the <i>SIP Request-URI</i>, the Media Server does not activate Clarity enhancement at the start of the session.</li> </ul> <p>If the <code>clarity</code> parameter is present in the <i>SIP Request-URI</i> but the Clarity profile parameters are missing, the Media Server rejects the SIP INVITE request.</p>
vol_adj	<p>The <code>vol_adj</code> Clarity profile parameter specifies the volume adjustment.</p> <p><code>vol_adj=&lt;Y&gt;</code></p> <p>where <code>&lt;Y&gt;</code> supported value ranges from -20.00 to +20.00.</p>



insert_gain	The insert_gain Clarity profile parameter specifies the insertion gain. insert_gain=<G1>_<G2>_<G3>_<G4>_<G5>_<G6> where GX (X is from 1 to 6) supported value ranges from -50.00 to +50.00.
comp_ratio	The comp_ratio Clarity profile parameter specifies the compression ratio. comp_ratio=<C1>_<C2>_<C3>_<C4>_<C5>_<C6> where CX (X is from 1 to 6) supported value ranges from -50.00 to +50.00.

The following example shows enabling the Clarity feature in the *Request-URI*.

```
sip:msml@host:port;clarity=1;vol_adj=1.0;insert_gain=9.6_17.6_23.0_23.0_21.2_21.2;comp_ratio=1.16_1.42_1.52_1.52_1.59_1.59;
```

```
sip:msml@host:port;clarity=1;vol_adj=1.0;insert_gain=9.6_17.6_23.0_23.0_21.2_21.2;comp_ratio=1.16_1.42_1.52_1.52_1.59_1.59;
```

## Profile Query API Interface

The SIP AS/TAS can query the subscriber Clarity profile parameters, as shown in the following example.

### Request:

```
curl --location
  'https://<<BaseURL>>/api/v2/accounts/<<AC-ID>>/clarity/profile/%2B<<Phone Number>>' \
--header 'Content-Type: application/xml' \
--header 'Apikey: <<API Key>>'
```

```
curl --location
  'https://<<BaseURL>>/api/v2/accounts/<<AC-ID>>/clarity/profile/%2B<<Phone Number>>' \
--header 'Content-Type: application/xml' \
--header 'Apikey: <<API Key>>'
```

### Response:

```
<Prescription>
  <VolumeAdjustment>20.0</VolumeAdjustment>
  <FrequencyBand centrefrequency="500">
    <InsertionGain65dB>19</InsertionGain65dB>
    <CompressionRatio>19.0</CompressionRatio>
  </FrequencyBand>
  <FrequencyBand centrefrequency="1000">
    <InsertionGain65dB>19.4</InsertionGain65dB>
    <CompressionRatio>19.11</CompressionRatio>
  </FrequencyBand>
  <FrequencyBand centrefrequency="2000">
    <InsertionGain65dB>19.9</InsertionGain65dB>
    <CompressionRatio>19.11</CompressionRatio>
  </FrequencyBand>
  <FrequencyBand centrefrequency="3000">
    <InsertionGain65dB>17.6</InsertionGain65dB>
    <CompressionRatio>15.16</CompressionRatio>
  </FrequencyBand>
</Prescription>
```



```
<Prescription>
  <VolumeAdjustment>20.0</VolumeAdjustment>
  <FrequencyBand centrefrequency="500">
    <InsertionGain65dB>19</InsertionGain65dB>
    <CompressionRatio>19.0</CompressionRatio>
  </FrequencyBand>
  <FrequencyBand centrefrequency="1000">
    <InsertionGain65dB>19.4</InsertionGain65dB>
    <CompressionRatio>19.11</CompressionRatio>
  </FrequencyBand>
  <FrequencyBand centrefrequency="2000">
    <InsertionGain65dB>19.9</InsertionGain65dB>
    <CompressionRatio>19.11</CompressionRatio>
  </FrequencyBand>
  <FrequencyBand centrefrequency="3000">
    <InsertionGain65dB>17.6</InsertionGain65dB>
    <CompressionRatio>15.16</CompressionRatio>
  </FrequencyBand>
</Prescription>
```

**Note:**

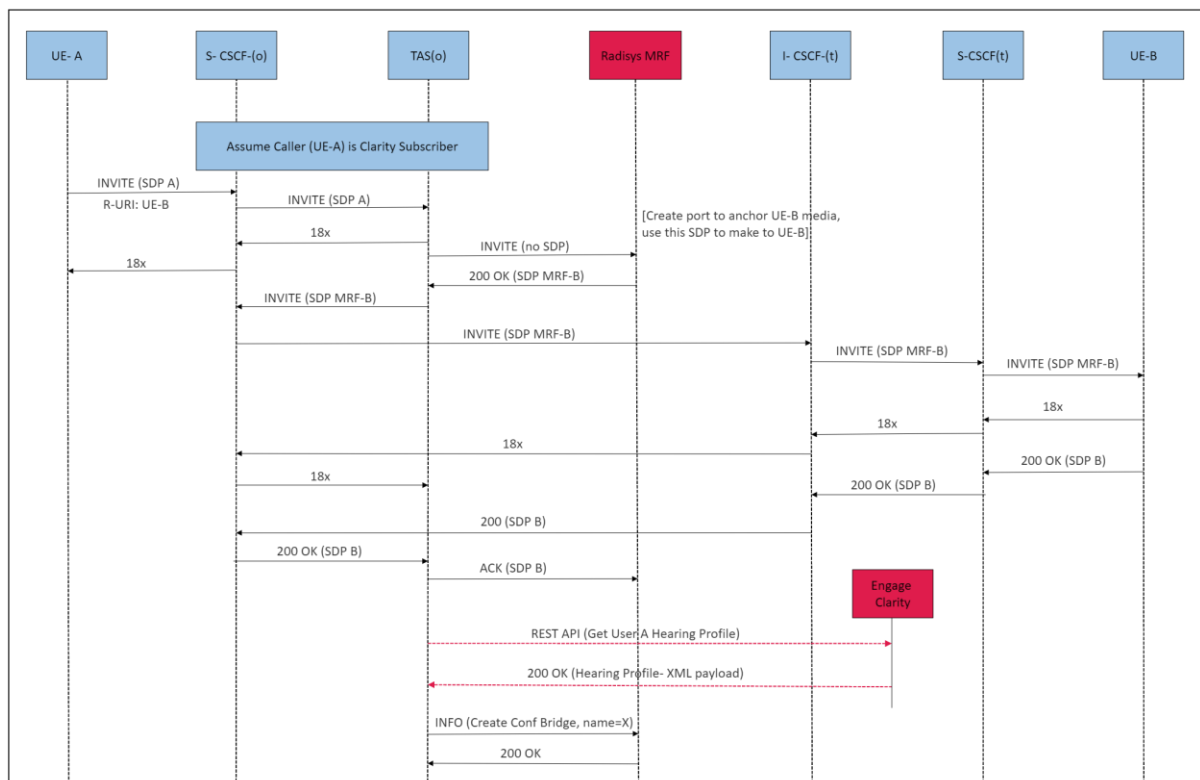


- The Clarity Profile API details, such as the API endpoint URL and API Key, must be specific to the Service Provider's deployment.
- The subscriber phone number must be the same as for the Clarity Profile creation.
- The subscriber phone number must be in E.164 format and escape encoded in HTTP R-URI, as shown above.

## SIP Call Flow

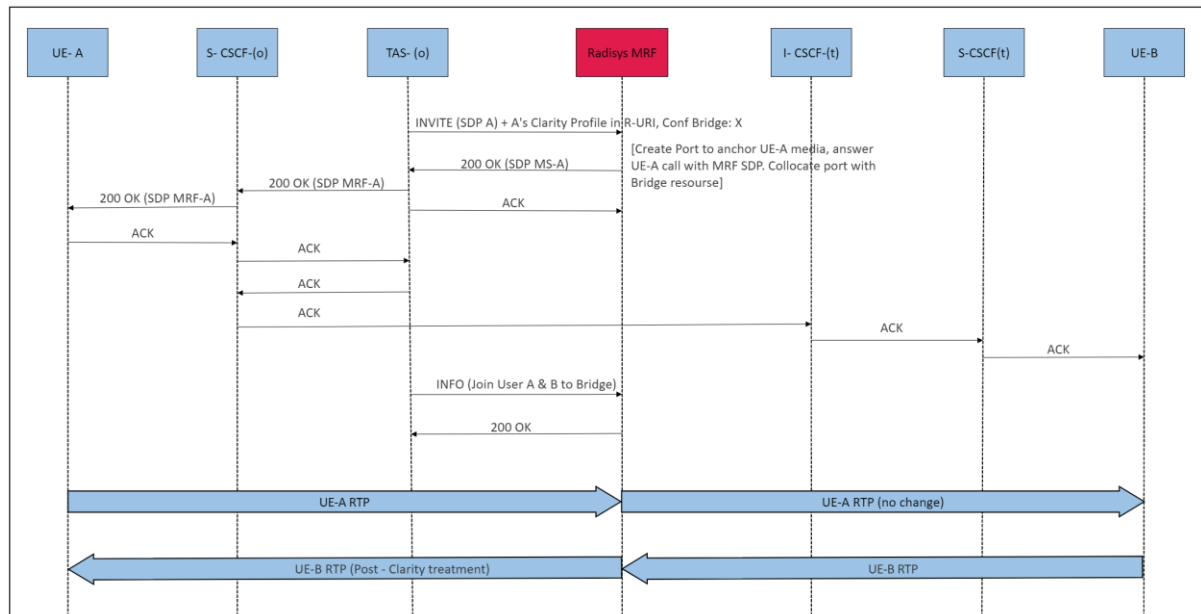
In the following sample SIP call flow, the Caller is a Clarity subscriber. A similar SIP call flow is on the Callee's side, assuming the Callee is also a Clarity subscriber.

**Figure 15. SIP Call Flow: Between MMTel AS/TAS and Engage Media Server**



In this sample media flow, the Caller and Callee are Clarity subscribers.

**Figure 16. Media Flow: Between MMTel AS/TAS and Engage Media Server**



## Engage Clarity Integration Call Flows



**Note:** Some integration call flows mentioned in this chapter may not be supported in the current Engage Clarity release. However, they will be supported in upcoming releases.

This section explains various call flow integrations with Engage Clarity.

- [Basic Two-party Call \(on page 35\)](#)
- [Two-party Call with Late Call Forwarding \(on page 43\)](#) (*Upcoming release*)
- [Third Party Calling \(on page 44\)](#) (*Upcoming release*)

### Basic Two-party Call

In EDP, a two-party call is allowed between the users (that is, Caller and Callee) through two outbound (A2P) calls and bridging them together. EDP supports two-party calls over landline (PSTN), mobile (2G to 5G), WebRTC clients, and SIP endpoints.



**Note:**

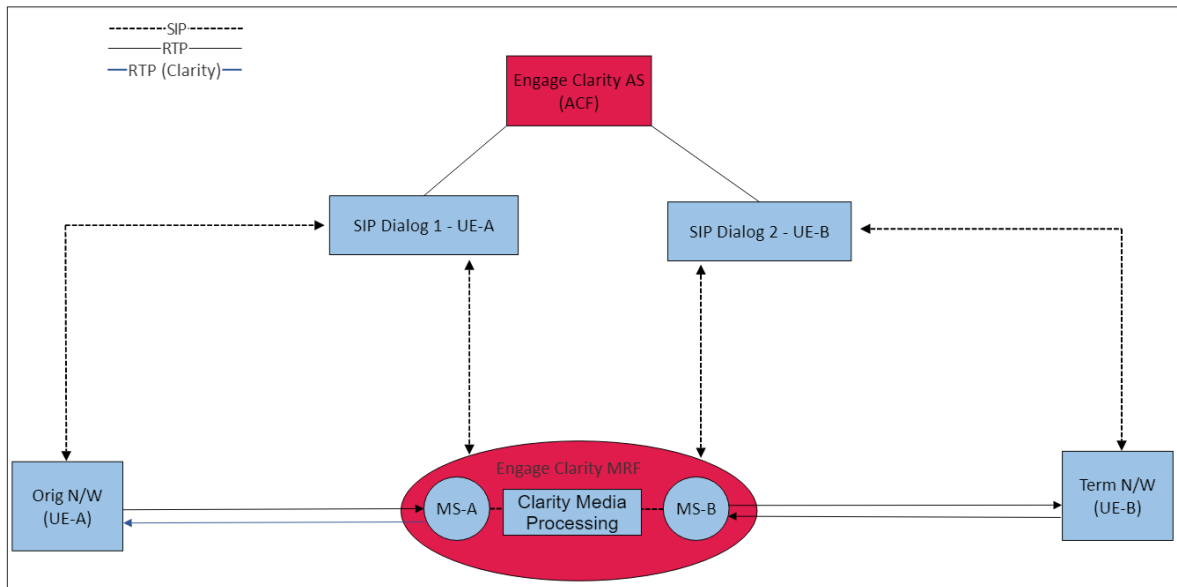
- Some integration call flows, such as mid-call hold/unhold and CRBT, may not be supported in the current Engage Clarity release. However, they will be supported in upcoming releases.
- In this section, the Caller is referred to as UE-A, and the Callee is referred to as UE-B.

#### **Two-party Call Between Caller (Clarity Subscriber) and Callee (non-Clarity Subscriber)**

The following figure shows a typical Clarity call flow between the Caller (a Clarity subscriber) and the Callee (a non-Clarity Subscriber).

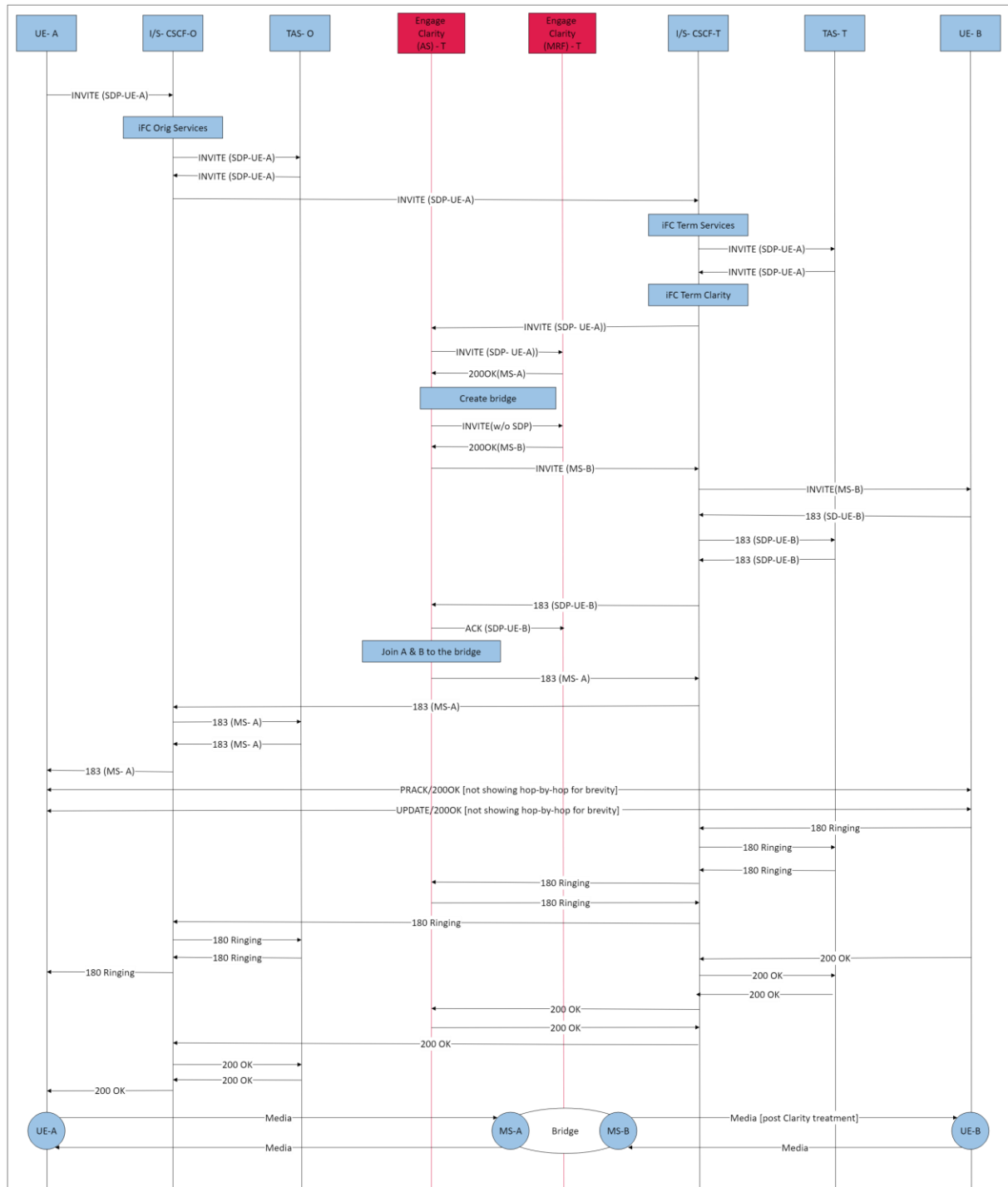
[illegible]

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**Figure 18. Media Flow: UE-A (Clarity Subscriber) and UE-B****Two-party Call Between Caller (non-Clarity Subscriber) and Callee (Clarity Subscriber)**

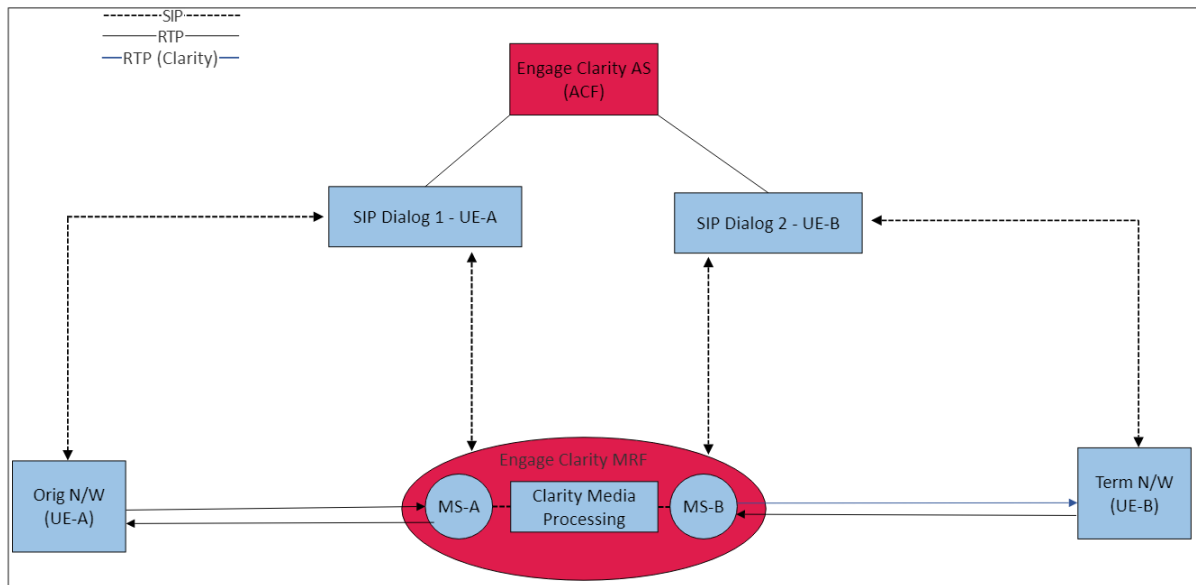
The following figure shows a typical Clarity call flow between the Caller (a non-Clarity subscriber) and the Callee (a Clarity Subscriber).

Figure 19. Call Flow: UE-A and UE-B (Clarity Subscriber)



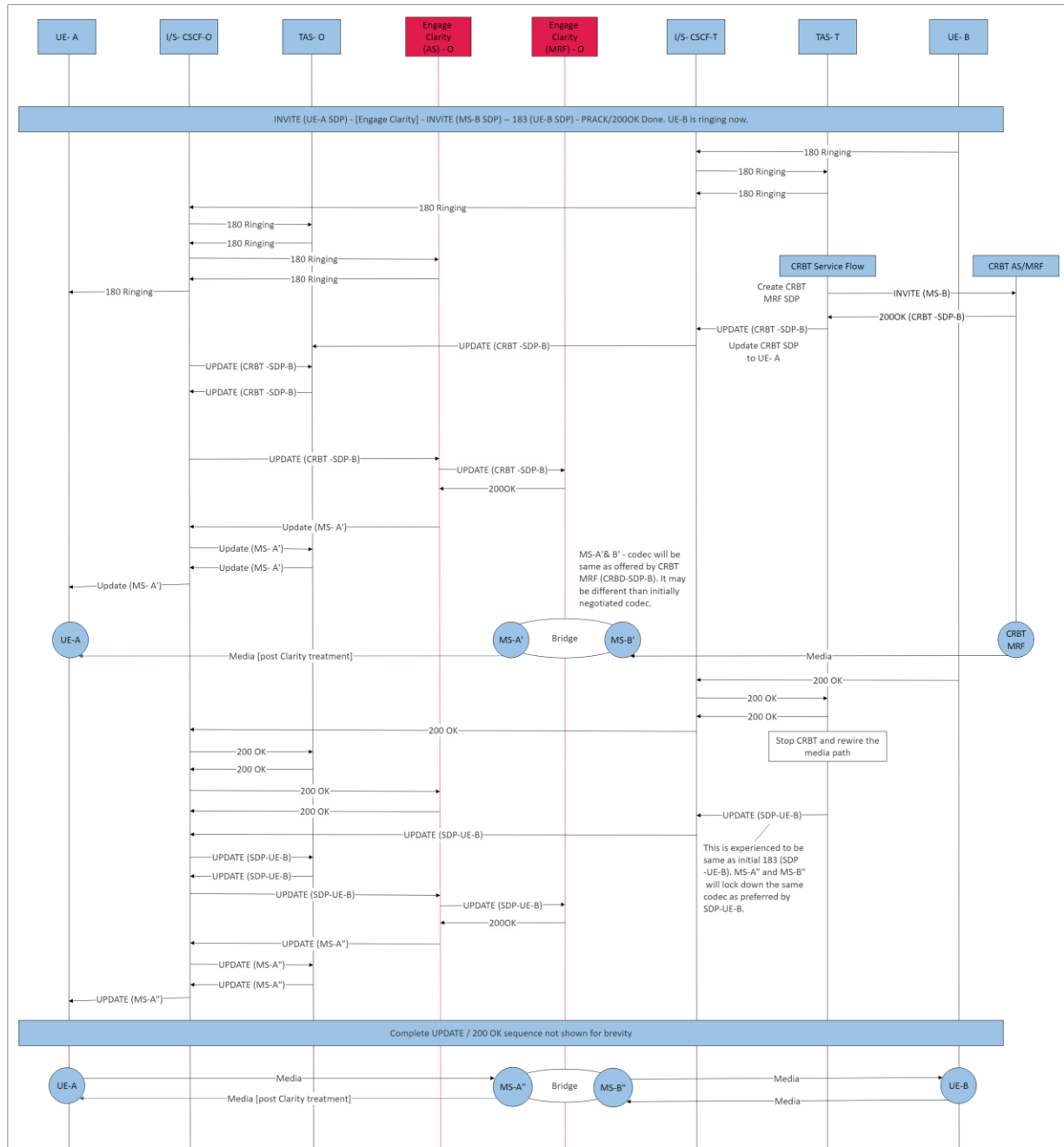
The following figure shows a typical media flow between the Caller (a Clarity subscriber) and the Callee (a non-Clarity Subscriber)



**Figure 20. Media Flow: UE-A and UE-B (Clarity Subscriber)****Two-party Call Between Caller (Clarity Subscriber) and Callee (using CRBT)**

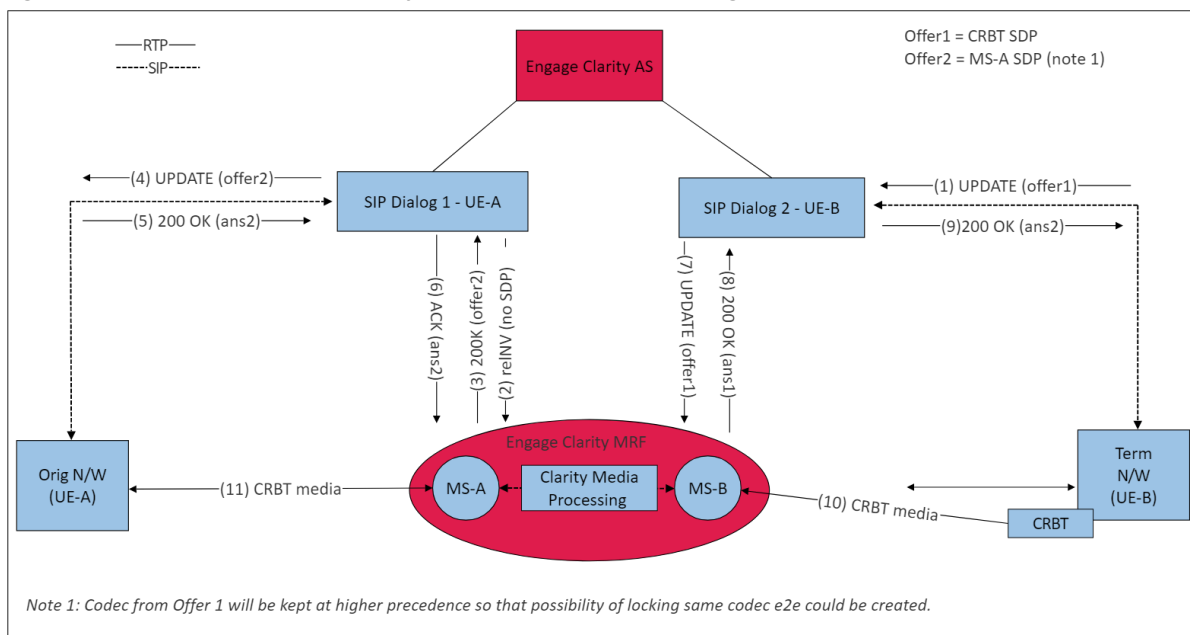
The following figure shows a typical Clarity call flow between the Caller (a Clarity subscriber) and the Callee (who is using Caller Ringback Tone (CRBT)).

**Figure 21. Call Flow: UE-A (Clarity Subscriber) and UE-B (using CRBT)**



The following figure shows a typical Clarity media flow between the Caller (a Clarity subscriber) and the Callee (using CRBT).

**Figure 22. Media Flow: UE-A (Clarity Subscriber) and UE-B (using CRBT)**



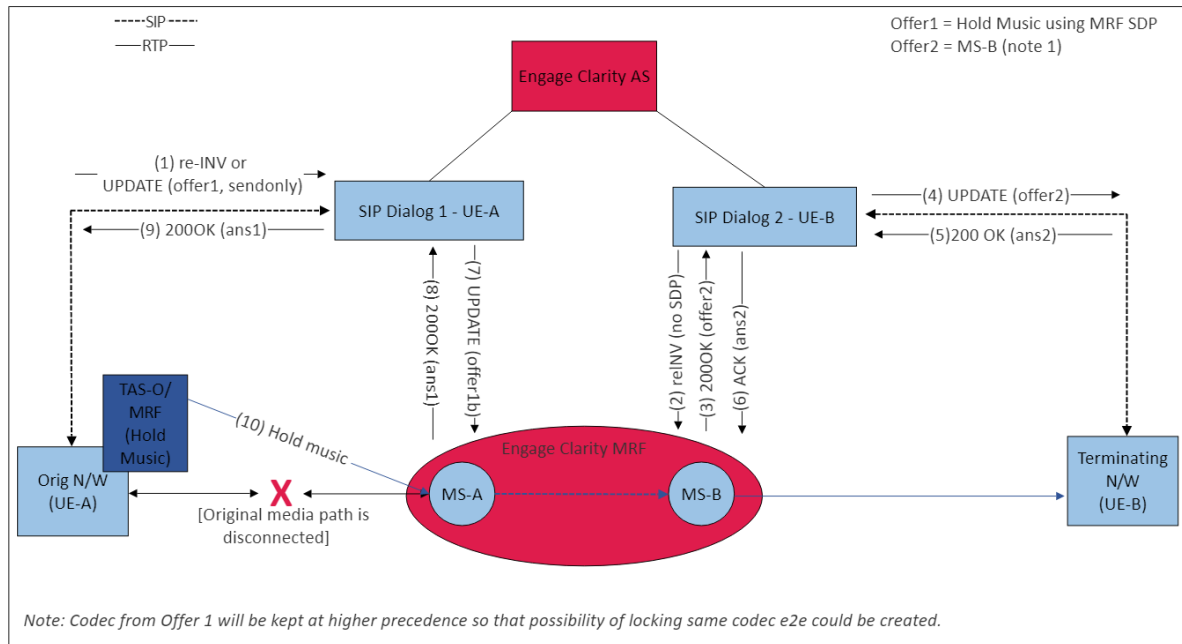
### Two-party Call Between Caller (a Clarity Subscriber) and Callee when the Caller is on HOLD

The following figure shows a typical Clarity call flow between the Caller (a Clarity subscriber) and the Callee when the Caller is on HOLD.

[illegible]

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**Figure 24. Media Flow: UE-A (Clarity Subscriber) and UE-B when UE-A is on HOLD**



## Two-party Call with Late Call Forwarding



**Note:** In this section, the Caller is referred to as UE-A, and the Callee is referred to as UE-B.

### Two-party Call Between Caller (Clarity Subscriber) and Callee who has Activated Call Forwarding

Below is a typical Clarity call flow between the Caller (a Clarity subscriber) and the Callee who has activated the Call Forwarding No Reply (CFNR) facility. In this case, if the incoming call is unanswered, it is forwarded to automated voice mail or similar services.

```

sequenceDiagram
    participant UE-A
    participant I/S-CSCF-O
    participant TAS-O
    participant EngageClarityAS as Engage Clarity (AS) - O
    participant EngageClarityMRF as Engage Clarity (MRF) - O
    participant I/S-CSCF-T
    participant TAS-T
    participant UE-B
    participant UE-C

    Note over UE-A, I/S-CSCF-O, TAS-O, EngageClarityAS, EngageClarityMRF, I/S-CSCF-T, TAS-T, UE-B: Case 1: UE -A is Clarity subscriber, UE -B has CFNR  
INVITE (UE-A SDP) - [Engage Clarity] - INVITE (MS-B SDP) -- 183 (UE -B SDP) - PRACK/200OK Done, UE -B is ringing now.

    I/S-CSCF-O->>TAS-O: INVITE (UE-A SDP)
    TAS-O->>UE-A: 180 Ringing
    TAS-O->>I/S-CSCF-T: 180 Ringing
    I/S-CSCF-T->>UE-B: 180 Ringing
    Note over UE-B: Starts Ring timer

    Note over UE-B: Timer expired
    UE-B->>I/S-CSCF-T: CANCEL
    I/S-CSCF-T->>TAS-T: CANCEL
    TAS-T->>I/S-CSCF-O: 200 OK (Cancel)
    I/S-CSCF-O->>TAS-O: 181 Call is being forwarded
    TAS-O->>EngageClarityAS: 181 Call is being forwarded
    TAS-O->>EngageClarityMRF: 181 Call is being forwarded
    EngageClarityMRF->>I/S-CSCF-T: 487 (Req Terminated)
    I/S-CSCF-T->>EngageClarityMRF: ACK
    I/S-CSCF-T->>UE-C: INV (UE-C)
    I/S-CSCF-O->>TAS-O: INV (UE-C)
    TAS-O->>UE-C: 183
    UE-C->>I/S-CSCF-T: UPDATE (UE-C)
    I/S-CSCF-T->>TAS-O: UPDATE (UE-C)
    TAS-O->>EngageClarityAS: UPDATE (UE-C)
    TAS-O->>EngageClarityMRF: UPDATE (UE-C)
    EngageClarityMRF->>I/S-CSCF-T: 183
    I/S-CSCF-T->>TAS-T: 200 OK
    TAS-T->>I/S-CSCF-O: 200 OK
    I/S-CSCF-O->>TAS-O: 200 OK
    TAS-O->>UE-A: 200 OK

    Note over UE-C: UE-B side clean-up
    Note over UE-A, I/S-CSCF-O, TAS-O, EngageClarityAS, EngageClarityMRF, I/S-CSCF-T, TAS-T, UE-B: Remaining flow ( i.e., 180 Ringing, 200 OK (call answer ) from UE-C ) is same as normal call setup
  
```

### Third-party Call among Caller (Clarity Subscriber) and Callees

Below is the typical third-party Clarity call scenario between the Caller (a Clarity subscriber) and the Calleees (Callee-B and Callee-C).

- The Caller makes a call to the Callee-B and puts the call on HOLD.
- The Caller makes another call to the Callee-C and puts the call on HOLD.
- The Caller then initiates a third-party call and joins the 3-party bridge.

## Engage Clarity in Existing VoLTE Network

The Engage Clarity solution can be deployed in the existing VoLTE network.

### Call Detail Record

When Engage Clarity is deployed as a SIP Application Server (AS), it supports generating the Call Detail Record (CDR) for each call leg separately. The CDRs are stored in the CDR database. The Clarity CDRs can be fetched using APIs and customized as needed. Engage Clarity supports other integration requirements with the Service Provider's CDR or Billing system.

### Reusing Existing Media Server

The Engage Clarity solution internally uses the Radisys Media Server in the IMS/VoLTE network. It has its own Media Server instances for Clarity media processing needs. The Service Provider can reuse their existing Radisys Media Servers. They must upgrade the Radisys Media Server license and software version that is compatible with the Engage Clarity solution. In this case, the Engage Clarity solution interfaces with the existing Radisys Media Server.



**Note:** Engage Clarity is a media transcoding service that requires intense compute processing. Therefore, reusing existing Radisys Media Servers or augmenting the capacity is based on due diligence and dimensioning.



## Engage Clarity for Roaming subscribers

The primary architectures for Voice Over LTE (VoLTE) roaming functionality are Local Break-Out (LBO) and S8 Home Routed (S8HR), as mentioned below.

### Local Break-Out Architecture

In the Local Break-Out (LBO) architecture, the IP Multimedia Subsystem (IMS) functionality is split between the Visited Public Mobile Network (VPMN) and the Home Public Mobile Network (HPMN). This means the VPMN is IMS-service aware, and both HPMN and VPMN must have deployed IMS.

- **Signaling Flow in LBO.** In the LBO model, the signaling is routed through the home network. This allows the home network to provide the advanced features the visited network may offer.
- **Media Flow in LBO.** The visited network routes the final media path in the LBO model. This means the actual voice or video data is transmitted through the visited network.

### S8 Home Routed Architecture

In the S8 Home Routed (S8HR) model, the signaling is also routed through the home network. This allows the home network to control the communication sessions, even though the user is roaming.

- **Signaling Flow in S8HR.** In **Signaling Flow in S8HR** model, the signaling is routed through the home network. This allows the home network to control the communication sessions, even though the user is in visited network (roaming).
- **Media Flow in S8HR.** In **Media Flow in S8HR** model, the final media path is routed through the home network. This means the voice or video data is transmitted through the home network, even though the user is in roaming.

LBO and S8HR architectures are crucial in enabling VoLTE or IMS roaming. While they have different requirements and offer various levels of control over the signaling and media flow, they aim to provide roaming users with high-quality voice and video services.

Engage Clarity is a media enhancement service provided by the user's home network. It requires signaling and media routing through the Home network for roaming Clarity subscribers. If the network adheres to S8HR roaming architecture, the Engage Clarity service will be seamlessly available when the Clarity subscriber is roaming. However, the Engage Clarity service is not provided to roaming Clarity subscribers in LBO roaming architecture.