5G MAG REFERENCE TOOLS </>

Conversational Avatar Real-Time Communications

3GPP — A GLOBAL INITIATIVE · MPEG

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Conversational Avatar Real-Time Communications
Introduction

Avatar representation and communication

- 3GPP [TR 26.813](#) documents the technical landscape necessary for effective avatar communication:
  - **robust avatar representation formats**
  - efficient methods for streaming avatar animations
  - signaling mechanisms for communication establishment
  - compatibility with existing AR-capable devices from smartphones to AR glasses & HMDs

- 3GPP Release 19 work focused on enabling 1-to-1 avatar communications to provide a robust foundation upon which more complex multi-party scenarios can subsequently be developed.

3GPP TR 26.813 V19.1.0 (2025-06)
Technical Report

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Multimedia Codecs, Systems and Services;
Avatar Representation and Communication;
(Release 19)

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MPEG Avatar Representation Format (ARF)

- **ISO/IEC 23090-39** defines a standard for interoperable storage, carriage, and animation of humanoid 3D avatars.

- Designed for **interoperability**, **extensibility**, and **portability**.
  - ARF provides a robust solution to meet the needs of conversational avatar communication.

- Key features:
  - Normalize avatar assets & animation - geometric models, skeletal structures, blend shapes for facial expressions - across devices and engines.
  - Support for multiple assets, LODs, and proprietary animation via mappings.
  - Security and authentication options to support avatar ownership with asset encryption.
  - Works with any scene description format.
   - Integration to MPEG-I Scene Description covered in ISO/IEC 23090-14.

ARF

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ARF – Base avatar format

- **ARF container**
  - ISOBMFF or Zip formats
  - Allows partial access to a subset of the base avatar's components - based on factors such as desired LoD (Level of Details), target bitrate, or user preference.

- **ARF document**
  - JSON entrypoint to the container with schema validation
  - Describes the avatar's structure and locates its components.
  - Provides metadata, identification and descriptive information, encryption and integrity options for content protection

Avatar container
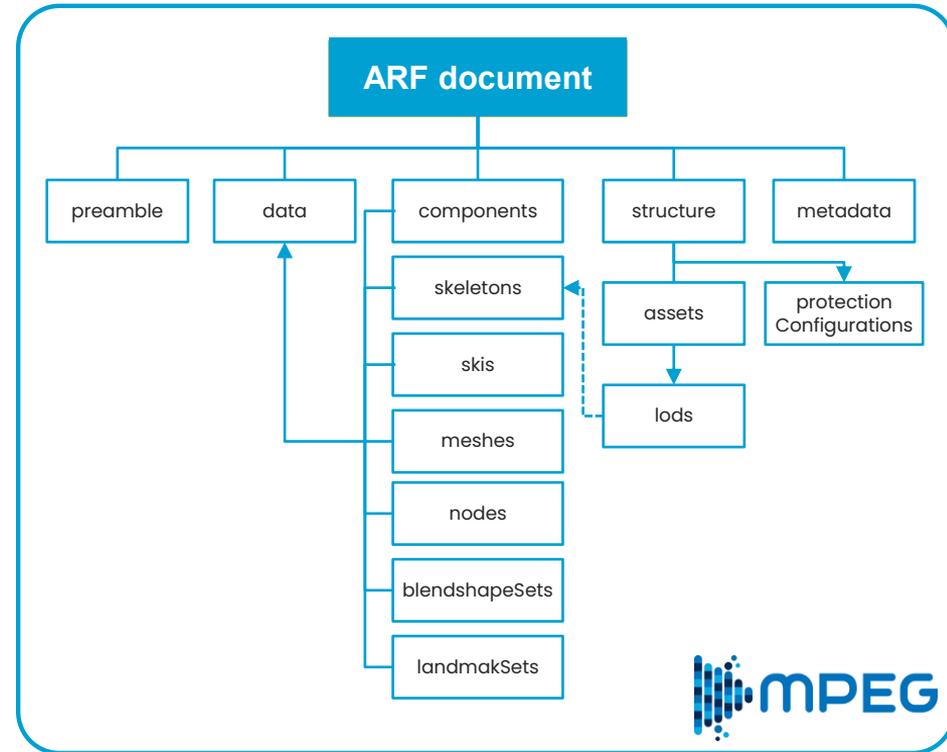
ARF – Animation Stream Format

- ARF specifies **Avatar Animation Unit (AAU)** of types: CONFIG, BLENDSHAPE, JOINT, LANDMARK with timing information:

  - **Facial animation**
    - *'Weighted blend shapes'* - (animation interpolates between a neutral base and a target mesh shapes)
    - *aau* provides the weight for a target 'blendshape set'

  - **Body/Hand animation**
    - *'Linear Blend Skinning'* - (deforms mesh geometry by blending weighted rigid transformations)
    - *aau* provides the transform associated to joints for a target 'joint set'
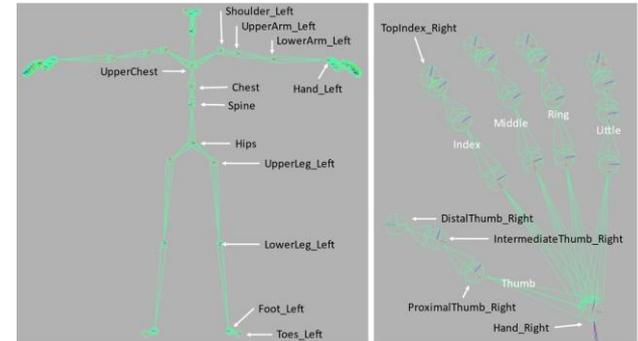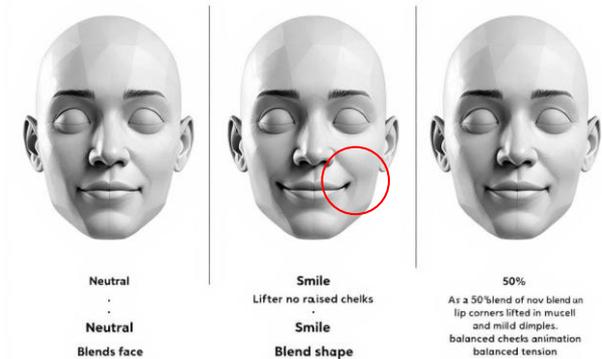
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Avatar calls in AR real time communication

- 3GPP TS 26.264 details the call flow to implement a real time avatar based AR communication.

- 3 main deployment scenarios for conversational avatar call:
  - **Receiver-driven**: Send avatar animation stream format data, receiver renders animated avatar.
  - **Sender-based**: Animate avatar locally, sending a final rendered stream to the receiver.
  - **Network-based**: Leverage Media Function based animation and rendering within the network - eg. to support lightweight devices such as thin AR glasses.

- In all these scenarios, a **Base Avatar Repository (BAR)** element is responsible for secure storage and management of user's avatars data.
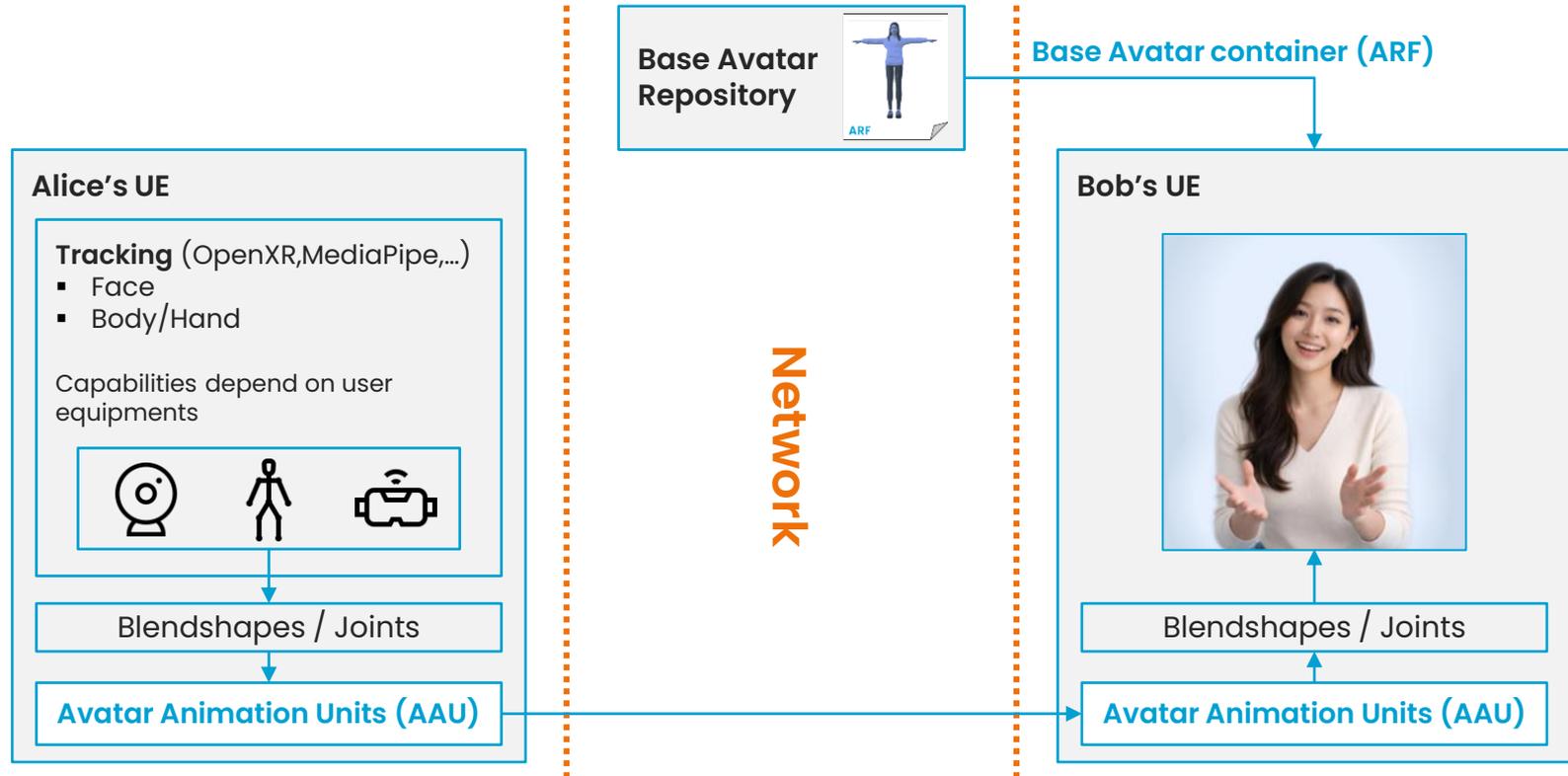
3GPP TS 26.264 V19.1.0 (2025-12)

Technical Specification

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
IMS-based AR Real-Time Communication
(Release 19)

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Avatar calls: receiver driven scenario

Base Avatar Repository

Base Avatar container (ARF)

Alice's UE

Tracking (OpenXR,MediaPipe,...)
- Face
- Body/Hand

Capabilities depend on user equipments

Blendshapes / Joints

Avatar Animation Units (AAU)

Network

Bob's UE

Blendshapes / Joints

Avatar Animation Units (AAU)

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Ongoing development at 5G-MAG

- Development focused on demonstrating 1-to-1 avatar communication using the ARF format, enabling "receiver centric" scenarios :
  - avatar real time call application implemented in the Unity 3D engine
  - leverages the ARF standard's reference software library (C++) for parsing ARF containers, encoding & decoding animation streams
  - using WebRTC for voice & data channels

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Links

- [3GPP TS 26.813: "Study of Avatars in Real-Time Communication Services".](#)
- [3GPP TS 26.264, "IMS-based AR Real-Time Communication"](#)
- [ISO/IEC 23090-39:2025 Information technology, Avatar Representation Format](#)
- [Avatar Representation Format (ARF) - mpeg-arf.org/](#)

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