



# Virtual Reality Platform

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## Introduction

Foretell Reality is a social Virtual Reality (VR) platform for professional use-cases that focus on authentic human interaction, collaboration, learning, and personal growth.

Our VR experiences, which include a variety of immersive environments and a broad range of tools, allow managers, therapists, coaches, and educators to leverage the unique capabilities of VR and extend the boundaries of remote meetings, soft-skills training and simulations, therapy and support groups, and experiential learning, to name a few examples.

We always strive for accessibility, comfort, and intuitive use by both first-time VR users and early adopters. Our user-experience is designed to bring people together seamlessly and accommodate a wide range of segments, including different age groups, levels of technological knowledge, and personal needs. Participants can remain anonymous by customizing their avatars and masking their voice so that concerns around stigma of physical appearance, age, or race can be mitigated. In addition, we make a robust use of three dimensions (3D) and 360-degree viewing that VR allows like no other preceding virtualization technology. To measure the impact of programs conducted in Foretell Reality, administrators can gather and analyze data such as user participation, interaction, speech, and eye contact.



## Key Use Cases

At Foretell Reality, we create new modalities to solve the limitations of practices and technologies that are currently used for the following use cases:

### Soft Skills Training and Collaboration

Recent studies indicate that virtual reality (VR) learners are 3.75 times more emotionally connected to their training content when compared to in-person learners. The immersive and seamless sense of personal, social, and environmental presence provided by VR, results in virtual spaces that feel real and are shared. This has far-reaching implications for training activities, many involve role-plays and simulations, on diversity and inclusion, team building, cultural competency, leadership development, and public speaking.

The fear of making mistakes often hinders learners from applying their newly acquired skills to real-world situations. The ability of VR to simulate challenging situations and provide learners with a safe space to practice their skills, without the fear of making mistakes, is a game-changer. By learning from their failures during immersive exercises, learners gain confidence and transfer their skills to the real world faster.

Foretell Reality offers distinct environments and tools to realistically simulate various business and entrepreneurial situations in VR. These include networking with other professionals, negotiating with company executives, practicing leadership and inclusion, or pitching a business idea to potential investors. Participants can assume different physical appearances, genders, and races to enhance empathy and understanding, and navigate any scenario imaginable. The platform also offers a variety of means to record and review individual and group performance, enabling learners to reflect on their progress and continue to improve their skills. With no physical location restrictions and availability at any time, Foretell Reality provides a truly innovative approach to training that empowers learners to achieve their goals.

## Therapy and Support Groups

The use of virtual reality (VR) for mental-health therapy dates back to the 1990s where VR was used for exposure therapy to treat war veterans suffering from Post-Traumatic Stress Disorder (PTSD). More recent technological advancements in VR, have made it possible for multiple participants to share and interact in immersive environments, enabling group therapy and support groups to be conducted virtually.

Therapy in VR has also been shown to have positive effects on pain management, relaxation, mindfulness, and social skills. By allowing individuals to change their environment and activity patterns in a matter of seconds, VR provides a unique opportunity to separate from daily surroundings and create a space for inner reflection and personal growth. This is particularly advantageous for those who are unable to travel long distances or find nature nearby, enabling them to experience novel environments and learn new coping mechanisms. With the ability to remotely socialize with others in 3D yet remain anonymous, expose to and experience real-life environments, and learn new skills, VR offers a truly transformative experience for mental health therapy.

Foretell Reality is a powerful tool that can be used by any support group population, providing people with the ability to connect and build networks of support from anywhere in the world. Our experiences also allow full anonymity, a highly important consideration for people who are seeking mental health support yet are concerned about revealing their true identity to others. A recent study conducted at Yale Medical School using the Foretell Reality platform for VR support groups for cancer patients demonstrated a significant increase in participation, from almost none to 73%, and helped build emotional resilience and a sense of community.





## Education and Learning

Foretell Reality is revolutionizing the way we approach immersive learning in both universities and K-12 education. Our VR experiences enable students to engage in a wide variety of exercises and simulations that are simply not possible in traditional classrooms or other online technologies. From inventory accounting simulations to field trips to professional working environments, Foretell offers a wealth of opportunities that were previously available only to a select few in well-equipped facilities.

Our platform is designed to support both fully virtual and in-person / hybrid schools, providing educators with a space for innovative curricula. Whether it's putting on a Shakespeare play or bumping into a friend while walking around a virtual campus, Foretell offers an experience that is immersive, engaging, and truly unique.

One of the key advantages of Foretell's immersive learning experience is the level of focus it inspires in students. Studies have shown that VR learners are 4 times more focused than e-learners and 1.5 times more focused than classroom learners. By stimulating students with immersive learning environments, and blocking out distractions like incoming texts and calls, students are able to concentrate on the task at hand.

We provide a wide range of tools to support different learning styles, including the presentation of 3D objects, 360 pictures and videos, 2D media, spatial drawing, and more. By offering a spectrum of media that is simply not available in traditional classrooms, we help to inspire engagement and productivity in students of all backgrounds and learning styles.



## Client-Centric

### Client Domains

As a B2B platform, each Foretell Reality client is given a virtual domain that keeps their ecosystem separate from those of other clients. This allows us to configure the VR experiences, features, roles, permissions, and system capabilities (e.g. number of concurrent sessions, number of users) that each client can access. Configuration can be modified, upgraded, or downgraded, based on the commercial terms with the client.

### Admin System

Through a web-based admin interface, each client can create their users, set up credentials, define roles and permissions, schedule meetings, and configure the attributes of its VR experiences. Clients can also upload media, including 2D images and videos, 360 images and videos, presentations, audio files, and 3D objects to share during their VR sessions.

### Roles & Permissions

The system allows setup for user roles and respective permissions at two levels:

- 1) System administration capabilities which determine whether a user is allowed to create new users, configure permissions, and select features available for each VR experience.
- 2) Experience capabilities which determine the functionality that is available for each role during a VR experience. A moderator has access to all experience functionalities and can grant or disallow access to regular users. Observers are users who are invisible to participants, cannot use all the capabilities that participants can, but can record and document the sessions.

### White-label Application

Our platform can be white-labeled and client-customized. Everything from the name, logo, and thumbnail of the client's app to the content in the environments - all can be tailored as a complete stand-alone experience.



## VR Experiences

### Environment Library

Foretell Reality platform includes a growing library of 3D environments that are interactive, easy to navigate, and pleasant to be in. Unlike 2D teleconferencing, our environments help all users feel like they are in the same “physical” space which creates a sense of comfort, community, and connectedness. All our environments have backgrounds, lighting, and special add-ons that use the potential of VR to create memorable experiences.

Each environment is tailored to evoke a feeling, whether it be professional, casual, friendly, or familial, and encourages users to actively participate, collaborate, and play with innovative tools. From indoor environments like a cozy meeting room with a porch to outdoor environments like a campsite where you can roast marshmallows and drink hot cocoa, clients can choose to include as many environments as they need for their enterprise use case.

### Meetings

Users can schedule meetings and invite others to join them in public or private settings. Public meetings are accessible to all users who belong to a certain client and are logged in, whereas private meetings are password-protected and / or invitee-only meetings. Every meeting is set up to start at a designated VR environment, yet participants can navigate to other environments within a meeting session.

### Multi-user Experiences

Taking into account the computing power of current VR headsets, our social VR experiences support up to 25 active participants and an unlimited number of viewers (observers) in one session. Larger audiences can be split into concurrent sessions, replicating the same VR experience, or join the primary session as viewers.

### Seating & Exploration Modes

Our environments are configured to have different seating arrangements like circles, rows, or panel discussions that allow comfortable seated VR experiences. Moderators can remove the seats and allow users to move around by teleportation or virtually walking in the space. When users, usually moderators, switch between environments, they can select a seated- or walking- mode and set up the number of participants who are allowed in the experience. If there are extra seats available, participants can switch seats when the functionality is enabled by the moderator.

### Customization

We work closely with our clients to understand their needs and tailor the VR experiences we provide them to solve concrete problems. In case our existing environments are not completely aligned with our clients needs, our in-house art team can build and customize the VR environments according to client's specifications, including environments that are based on bespoke 3D models, computer-generated designs, or photogrammetry.



## Representation

### 3D Avatars

Our users are virtually represented as 3D avatars in Foretell's VR experiences. 3D Avatars provide a sense of individuality as well as expressiveness that can add color and diversity to a virtual group setting. Each user has the opportunity to customize their avatar before and during sessions and can reflect a wide variety of ages, races, genders, and professions with their appearance.

### Avatar Packages and Customization

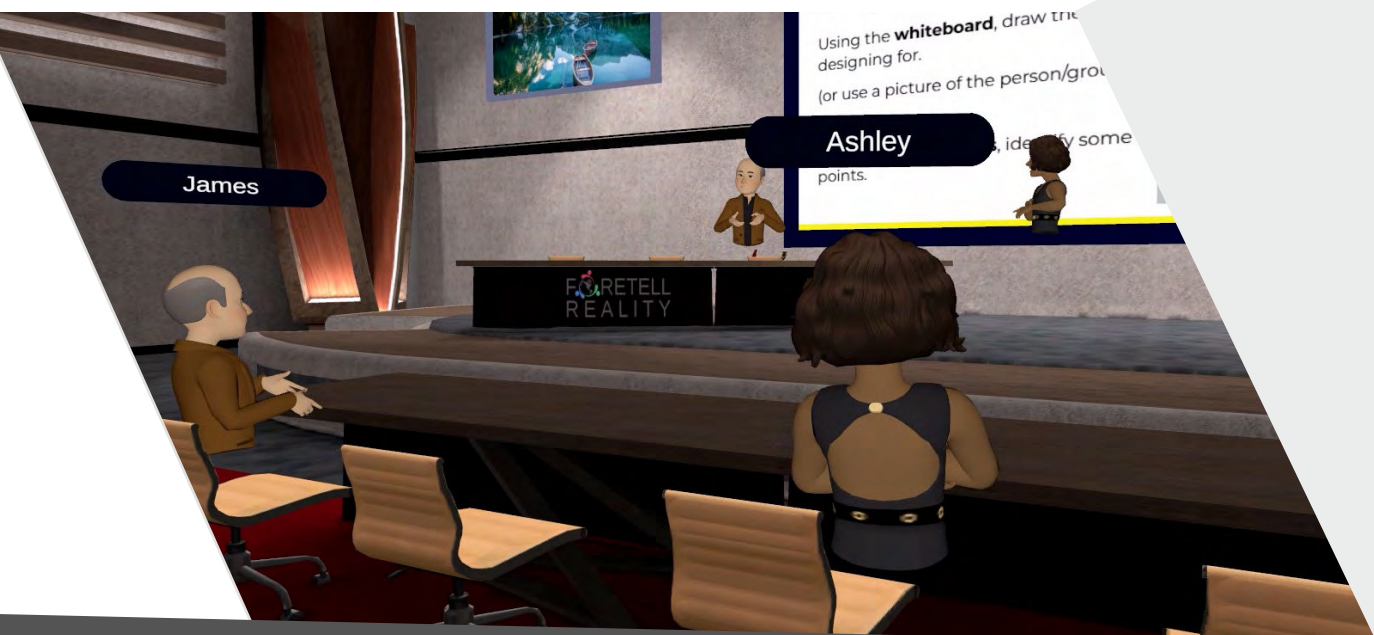
We offer several packages of avatars with various customization options for face, skin tone, hairstyle, hair color, attire, and even age. For Quest headsets, we support Meta avatars with full torsos, facial expression tracking, and eye tracking. For other headsets we use Ready Player Me avatars that are equally customizable and colorful yet have half torsos and no facial tracking features. Custom sets of avatars can be developed to address a client's specific needs.

### Voice Masking

Foretell offers voice masking as well as tone and pitch modifications for privacy, anonymity, and advanced simulations that are essential for receiving therapy, role-plays, exploration of different identities, and safe self-expression.

### Mirrors

Other than observers who do not have an avatar representation, users can view their personal avatars through a virtual mirror and capture-features we provide like recording in 3D and 2D, and taking 2D pictures. Allowing users to see their virtual representations enhances avatar embodiment and helps users to settle into their select identity and virtual appearance.



## Communication

### Spatial Audio

We support 360 spatial audio where the volume changes based on direction and distance from audio sources. Users hear people that are close clearer than ones who are far away. This feature allows users to have private conversations in large virtual spaces by physically moving away from other participants. Spatial audio can also be turned off, in which case users hear each other from a distance regardless of their location in the virtual space.

### Muting

Users can mute and unmute themselves through the menu, and moderators can mute other participants to control a productive discussion, presentation, or event.

### Secret Chat

Our Secret Chat features allow participants to speak with each other directly without revealing their conversation to others. Moderators can leverage this mode to guide discussions or give directions by 'whispering' into a user's ear during sessions.

### Coach Mode

In addition to communicating directly and secretly with other participants, moderators can choose to become invisible and leave the scene (while still observing) and realism to guided role-play exercises, as an example.

### Body Language

Users can communicate with each other nonverbally through their gestures and body language, allowing for more engaging and effective dialogue. This allows conversations to be more immersive and natural than traditional video calls, as is the case in in-person meetings.

### Hand & Head Gestures

Using controllers or hand tracking, users direct the movement of their avatars' hands, making gestures like pointing, fist-bumping, raising a hand, and hand-shaking with haptic feedback. As users converse and move their heads, their avatars automatically and naturally move in the same way, allowing for conversations that feel similar to in-person interactions.

### Emotions

Users can use emoticons to express their emotions and feelings towards each other. In advanced headsets that support facial tracking, supported avatars reflect the user's facial expressions.

### Banning

Moderators can ban disruptive participants from sessions that interrupt the communication. Banned users are unable to join the session until the ban is removed.

## Movement

### Six Degrees of Freedom (6DoF)

Our platform supports 6DoF VR headsets that allow users to walk within the physical space and track their movement with precision that moves their corresponding avatars accordingly. The same experiences but on 3DoF devices limit users from reflecting their physical movement in the virtual space accurately.

### Navigation

Users can navigate to different areas in the VR scene either by moving in real life within the physical boundaries they define for their headsets, or by using the controllers to walk, step, or transition quickly (teleport) to farther distances in the virtual space.

### Seat Changing

In seated experiences, participants can change seats by clicking on an empty seat if enabled by a moderator. Seats can also be reserved for specific users or roles, like the moderator of a session.

### Hand Tracking

On devices that support hand tracking, our experiences allow controller-free movement of user avatar's hands and fingers that match the real-life hand movements of the user.

### Eye Tracking

On devices that support eye tracking, our experiences allow for increasingly expressive avatars and deeper analytics, for example of eye-to-eye contact. Directional gaze tracking is also available on all headsets.

### Life-like Physics

Participants can pass 3D objects like balls, tools, images, and documents to each other, and place them within the VR scene. These objects can "behave" as in real life, or leverage VR to defy the laws of physics. For example, a bouncy ball can bounce around the room, or can be set to float mid-air according to the intended use case.



## Recording Options

### 3D Recording

Moderators can 3D-record sessions and replay them within and in other meetings. All recordings can be saved and shared outside the app in .mp4 format, depending on permissions.

### 2D Recording

Cinematic recording mode enables our desktop client users to create engaging 2D videos. Vtubing mode can also be leveraged to create unique shots with a handheld camera in the scene. 2D recordings can be played back in VR, desktop, and mobile versions.

### Live Broadcasting

Admins have the ability to live broadcast a video feed (180 degrees or 360 degrees) into the VR environment.

## Analytics

### Metrics

Our basic analytics package includes two main metric categories:

1. Usage - showing who used the system for how long.
2. Performance - showing actions such as talking, gazing, steps performed during a training procedure, and other custom-metrics that are collected specifically for each experience.

## Support

### Technical Support

We have detailed documentation for onboarding new users at a large scale. Our support team offers White Glove onboarding and on-demand live support.

### Alerts & Notifications

Our applications send in-experience alerts to users when internet quality is subpar, network latency is high, and headset battery is low. With these notifications, users are aware of potential issues in their experience and may be able to resolve on their end (e.g. internet speed).

## Device Agnostic

Foretell Reality can be accessed from almost any tethered and standalone Android VR headset (e.g. Meta Quest, Pico Neo), as well as desktop and laptop computers (Windows and Mac). VR headsets are exceptional for experiencing the presence of other people and the immersiveness of our experiences, while desktop devices are better suited for observing sessions and typing notes.



# Foretell Reality Technology

## Overview

Foretell Reality consists of a system comprising a VR application, that runs on several headset types, and sibling applications for Mac and PC desktops. The Foretell Reality application communicates with a backend over secure web services. Foretell includes a

web based administration portal for managing users, scheduling meetings and configuring implementations. It can alternatively integrate with third party administration tools, allowing clients to continue using their existing user accounts and scheduling systems.

## VR App

### Supported Platforms

Our VR application is deployed to the following platforms:

- VR headset types (such as Meta Quest and Pico), deployed via the respective application stores and via Mobile Device Management (MDM) services.
- Mac and PC Desktops, deployed as signed installers.

The application for each platform is built from the same exact codebase and users can join meetings with other users across platforms. The application is developed in the Unity Engine and coded in C#.

### Deep Linking

We enable deep linking from other headset-based VR apps to the Foretell Reality VR app, and vice-versa. For Oculus deployments, we use the Oculus Platform utilities for deep linking. Non-Oculus deployed apps use a java object interface, using standard android deep linking protocols.

## Customization and White Labeling

### Default Foretell Reality App

The default Foretell Reality VR app automatically configures itself for the client tied to a client code that a user logs in with. Client-based configuration includes use of client specific logos, choices about available experiences, avatar types, and more. This also allows us to react to client-specific license terms (e.g., number of concurrent sessions).

### White Label Foretell Reality App

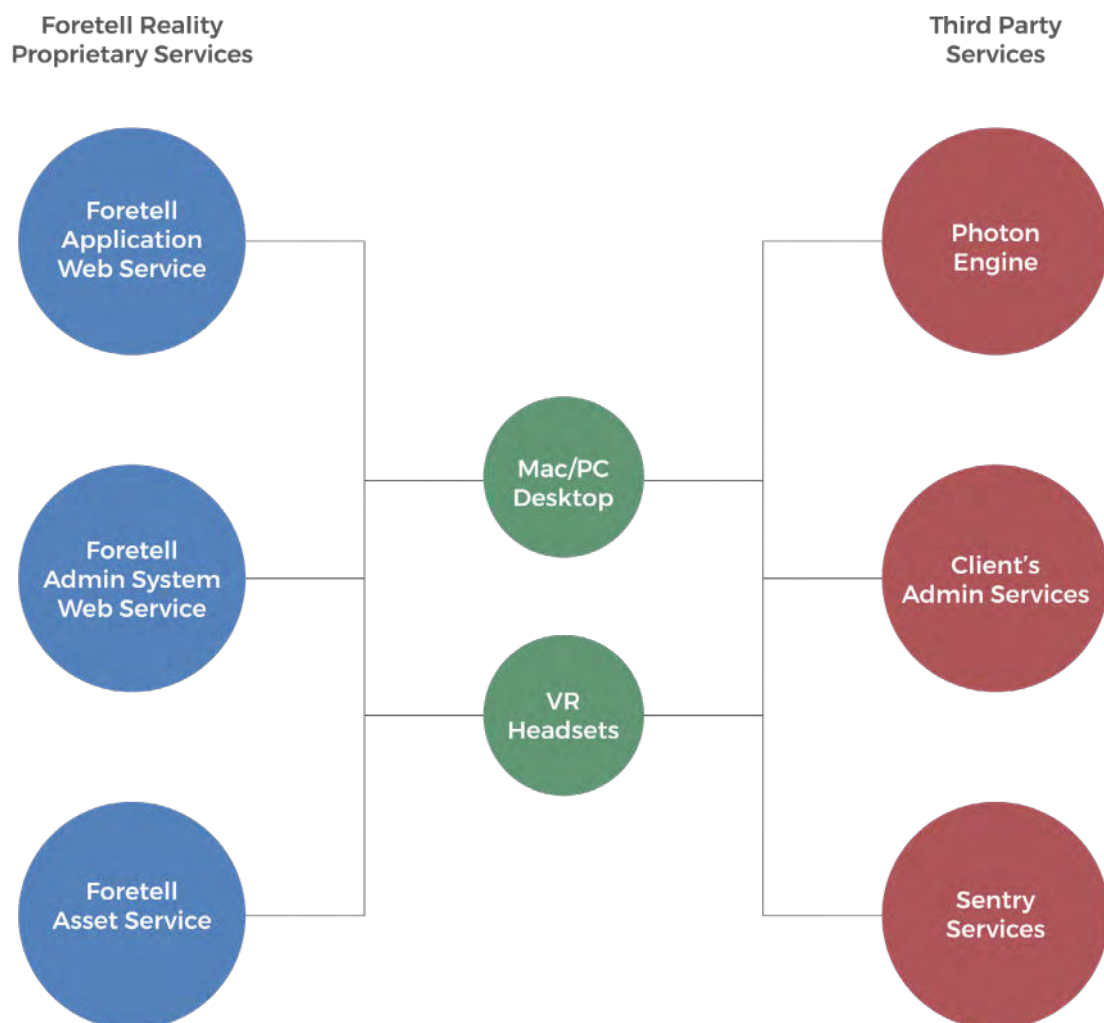
Foretell Reality can also be compiled and deployed as a white-label app, specifically configured and branded for an individual client. A white-label app accesses the same backend client configuration data as the default Foretell Reality app but uses a preset client code (i.e., not entered by the user). Additionally, a white-label app is fully branded with its own store icons and splash screen. Note that a white-label app is still built with the same code base of the generic Foretell code so that we do not need to maintain multiple codebases.

## Web Services Used by Foretell Reality Applications

Foretell Reality accesses Foretell Reality Web Services via Secure Sockets to:

- Interface with Foretell user management and scheduling systems.
- Interface with client and 3rd party user management and scheduling systems.
- Interface with Foretell systems for customization choices and tracking metrics.

It also accesses third party services, including industry standard web service systems as well as web services that our clients might employ for their own user management, scheduling and analytics.



## Foretell Reality Proprietary Services

We have detailed documentation for onboarding new users at a large scale. Our support team offers White Glove onboarding and on-demand live support.

### Foretell Application Web Service

This backend service serves the VR application and the Metrics section of the frontend Admin System Web Portal described later. This service receives and delivers data relating to:

- User specific configuration such as avatar choices.
- Usage metrics such as entrances and exits from meetings, speaking, gazing at other avatars, and media watching details.
- Performance metrics based on expected results.
- Diagnostic information such as type of device used, operating system, wifi/battery quality, and audio quality.

## Third Party Services

### Photon Engine

Photon is an industry standard multi-user service through which the application shares data amongst running instances of the application. Its primary purpose is to share head, body and hand positions, and users' speaking tracks among users in the same Photon room. We further use photon services to share behaviors, avatar choices, and data for syncing media and other dynamic states amongst users in the same room.

### Foretell Admin System Web Service

This backend service serves the VR application and the frontend Admin System Web Portal described later. This service receives and delivers data relating to:

- Client Specific configuration.
- User management.
- Meeting schedules.
- Meeting management.

### Foretell Asset Service

Assets are managed in an AWS S3 Bucket and delivered via the Cloudflare Content Delivery Network (CDN). Assets include the following types which can be imported into the VR application via the Foretell Web Services:

- Flat and 360 degree videos.
- Flat and 360 degree images.
- PDFs.
- Audio.
- 3D objects.

### Sentry

The sentry service allows us to track diagnostics and track errors that occur on both our development and production environments. We configure it to differentiate between different versions and different environments and give us insight into where problems are occurring and assist in finding root causes. No Personal Identifiable Information is sent to the sentry service.

## Security

### Web Services security

All Web services are accessed over Secure Sockets Layer (SSL), a standard security technology for establishing an encrypted link between a server and a client. The Foretell Reality Web Services are all accessed in encrypted calls over https (which enforces SSL), and we require that any 3rd party web services or web services managed by our clients are accessed in encrypted calls over https.

### Passwords

All stored user passwords are encrypted with a one way hash, so that they can never be decrypted or read as clear text. Any password management happens exclusively in the backend, limiting password exposure. We use the Python werkzeug security utility to generate the hashed content. This utility uses the PBKDF2 key derivation function with SHA-256, and 16-character salt to generate the hash.

Upon successful login, users receive a JSON Web Token (JWT), stored locally in the browser and used on all subsequent requests to the backend.

## Foretell Admin System Web Portal

The Foretell Reality Admin System Web Portal is a web based portal through which:

- Foretell super-admins configure clients.
- Client admins manage users and schedule events.
- Client admins manage media and 3D assets for use in the Foretell Reality VR application.

This frontend application receives data from and delivers data to the Admin System Web Service previously described.

The Admin System Frontend is a single page application developed in Angular/Typescript accessed over secure https via standard web browsers.

User access to the Admin System is role-based:

- Only superadmins (who would be Foretell agents) can add or modify client level configuration relating to contract based setup.
- Only Admins (who would be client personnel assigned by the client) can:
  - Add or modify users, roles and permissions.
  - Schedule and configure meetings.
  - Assign media and 3D objects to meetings.
- Viewers can only modify their own user information.



## Architecture

### Overview

The Foretell VR Application, and the sibling desktop applications are built on top of our proprietary layered architecture, the Foretell Chassis. This architectural overview gives insight into how the Chassis is used to create custom applications that can be used on a wide variety of equipment and provide a wide variety of functionality.

The Chassis is composed of multiple “Components”, shown as blue boxes in the diagram. Each Component is custom software that presents a uniform interface to a white-label Application. By writing to this uniform interface, the same application code can be used to drive multiple hardware devices, interact with multiple backend servers, use a variety of avatar systems, and leverage a wide variety of functional widgets.

The orange boxes give examples of devices, servers, and interfaces that each of our applications can interact with, without writing application-specific code.



The Application code can be built to run on:

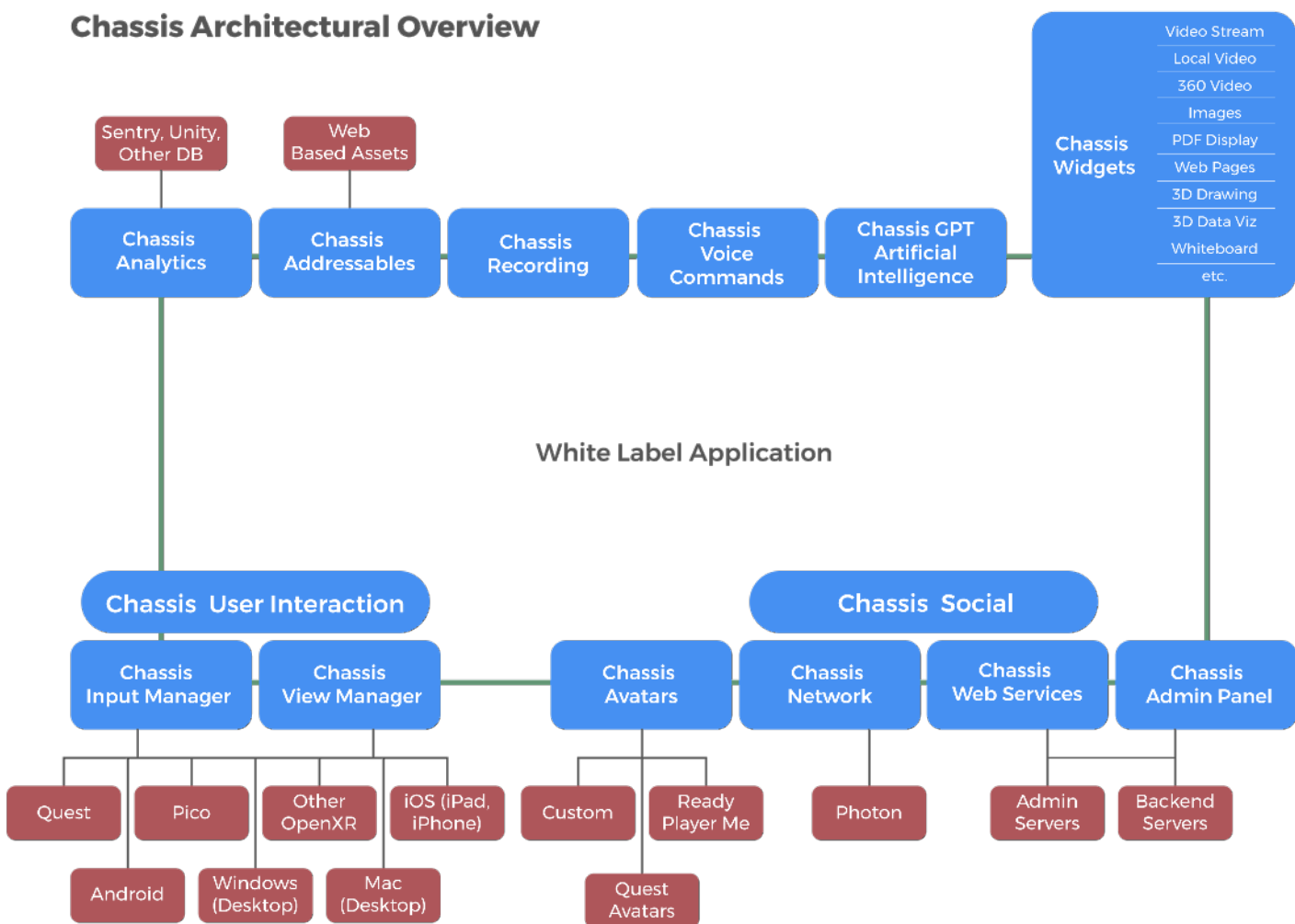
- Various VR devices such as Quest, Pico, and Vive.
- Desktops such as PCs running Windows and Macs running MacOS.
- Mobile devices such as iPhone, iPad, and Android phones.

The code is built to work with various backend services, such as AWS S3 as well as custom servers that provide a variety of ready-made functions for the customer and the customer's end users.

It supports integration with Ready Player Me avatars, Meta avatars, and custom avatars.

Foretell Chassis also provides a variety of functionality that can be integrated in application builds, including GPT AI, Google Cloud Voice driven commands, record and playback, analytics, and a wide variety of multimedia. This multimedia includes video, streaming video, 360 video, 2D images, PDF files, Web pages, 3D Drawing, 3D Data visualization, and importing 3D objects.

## Chassis Architectural Overview



## Device Management

The Chassis provides a generic interface to Foretell Applications to receive user input and to control output to the user. In the diagram, this is represented by the Chassis User Interaction, Input Manager, and View Manager components.

This generic interface provides for a wide variety of input devices. These input devices can be real physical items, like a VR hand held controller, or virtual devices, like UI on a mobile phone screen that emulates the actions one might make using real physical items.

Because these items are represented with Chassis identifiers, the Application is insulated from having to know that the device it's being built for is a Quest, Pico, desktop, etc. The virtual device interface allows the user to implement functions that may not otherwise be available on their particular device. For instance, on the Keyboard interface, the user can use keyboard buttons to move around, and mouse motion to "move his head". This gives the same functionality as wearing a headset and walking around while turning your head. The Application need not have to differentiate. It will get head and body motion info the same way when built both for a Quest and a PC.

## Network Based Functionality

The Chassis provides a uniform interface to a variety of network based services through its Chassis Social component. This component allows the Application to support multiple users who can interact with each other. User management is done through backend servers that allow the client to control its users' access. User assets such as documents, videos, etc. can all be managed via web page by the client.

This component also manages user data. Users can customize their avatars and store the details on Foretell backend servers. Thus users get the same experience across different devices.

## Avatars

An avatar is an important abstraction for VR users. A user's avatar is the user's visual representation. The Avatar component provides a uniform way of accessing the avatar, whether it is a Ready Player Me avatar, a Meta avatar, or a custom avatar.



## Artificial Intelligence (AI) and Voice Interaction

The Chassis provides access to OpenAI GPT as well as Google Cloud Voice. Combining these features allows for powerful natural interaction with Artificially Intelligent non-human virtual characters. Simply speak to the character. Your voice is converted to text with remarkably high accuracy in remarkably tolerant audio environments. Your interaction is routed through GPT and the result is that the non-human virtual character speaks to you with a high quality natural voice. This voice system can also be used to issue commands in VR, instead of having to type or to hit confusing buttons.

## Recording and Playback

The Chassis provides the ability to record and playback virtual interaction in 3D. This is NOT simply video. The actions of the various people and virtual characters can be recorded and played back. Because this data is the actual motion and sound the characters make, you can view this action from any angle.

## Cloud Based Asset Storage

The Chassis provides the ability to store assets on the cloud and pull them into the playback device at runtime. This allows for smaller

applications that start faster. Assets can be virtually anything, such as environments, objects, or media. This also has the added benefit of allowing assets to be updated after the Application is delivered to the device. The asset that is referenced can be modified after installation.

## Analytics and Diagnostics

The Chassis records a wide variety of analytics and diagnostics data. System operation and performance can be accessed via Unity Analytics or Sentry DB. Number of runs, who ran what, and when it was run are available. In addition, user actions can be tracked, including application use, user motion within an application, how users interact with others, and more.

## Widgets

The Chassis provides a spectrum of media and interactions via a variety of widgets, including:

- Viewing 2D videos, 360 videos, images, pdf files, and web pages.
- Drawing in 3D space.
- Analyzing data on a 3D grid.
- Sharing ideas on a whiteboard.
- Playing with cards.
- Bouncing a ball with other users.





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