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Overview

The **Client-Side Prediction (CSP)** system is designed to provide a seamless and responsive multiplayer experience by predicting game states locally on the client. This system is built around a modular architecture that allows for flexible and extensible design, enabling systems that behave as if the game were single-player, while still synchronizing with the server automatically.

Key Components

1. **PredictionManager**:
   - Acts as the central "world" for client-side prediction.
   - Manages all predicted entities and systems.
   - Handles the lifecycle of predicted states, including prediction, reconciliation, and view updates.

2. **PredictedIdentity**:
   - Unity components that define the behavior of predicted entities.
   - Created by users to handle specific functionalities, such as movement, physics, or custom logic.

3. **PredictedHierarchy**:
   - Provides a prediction compatible version of Unity's Instantiate and Destroy methods.

Design Philosophy

- **Decoupled from Traditional Networking**:
  - This system is completely disconnected from the usual `NetworkIdentity` setup.
  - **RPCs (Remote Procedure Calls)** are not supported or needed in this architecture, as prediction handles state synchronization naturally.
  - Logic is executed locally on the client, mimicking a single-player experience, while still maintaining consistency with the server.
  - This approach simplifies development, as developers can focus on writing game logic without worrying about networking intricacies.

Benefits

- **Responsive Gameplay**: Predictions provide immediate feedback to the player, reducing the perceived latency.
- **Modularity**: Systems can be easily added or modified, allowing for flexible and scalable game design.
- **Consistency**: Reconciliation ensures that the client's state aligns with the server's authoritative state, maintaining a consistent game world.

Limitations

- **Prediction Errors**: Incorrect predictions may require corrections, which can occasionally result in visual "snapping" or adjustments.
- **Complexity**: While the system simplifies networking, it introduces new challenges in managing predicted states and reconciliation.

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