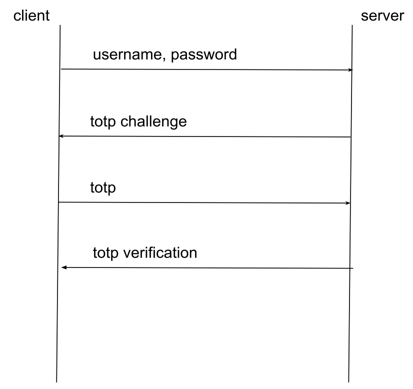
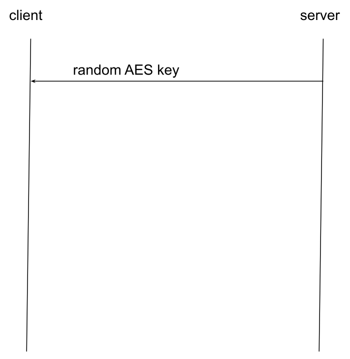
## Login



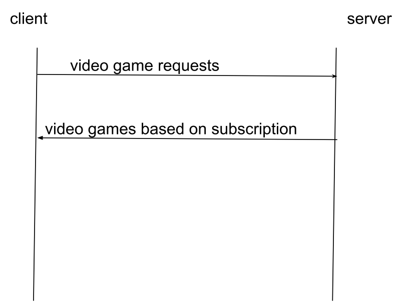
For this protocol, the client starts by sending the username and password to the server. The user has to type in those two pieces of information and then the client will send them. This will let the server know who is joining in order to be able to know which user is doing what. This includes attacks, so if a user commits one, the server would know which one did it. The server then lends the client a TOTP challenge. Then, the user types in the TOTP. This is the code that is shared only between the client and server, and the reason for using this is that attackers will not have access to the account of the user even if they know their username and password. This will reduce the risk of attackers using their account.

## Key Exchange



A random AES key is given from the server to the client. This key will be shared only between the server and the client. This will ensure confidentiality for the user. Plus, since this is an AES key, the encryption will be done much faster.

Secure Session



In this protocol, the client sends the video game requests to the server. Here, the user types in the video games they want, and the server will know in order to give the games. Then, that server will recommend video games based on the subscription. By knowing about the subscription the user has used, the server would have a clue of what they might be interested in. This is because the subscription contains certain games that the user will be interested in playing.

## Security Measures

**Authentication:** The login process (username, password, and TOTP) ensures that only the right user gets in. The password is hashed using SCrypt with a salt, which keeps it secure on the server side.

**TOTP:** Is  the second factor, making it even harder for attackers to get in, even if they know the password.

```
{
        "password" : "Pc9B2DvF7/uLJ/Br9xPRDy8HZnS1uDexF+WOnKTS4jA=",
            "totpSecret" : "xh25qufvajoifsztneb3wrxwgaa53ffm",
             "salt" : "vmiyavuYruAWPz0er4k6Hw==",
             "hmacKey" : "byrQHp5lYhHOhlfwuViKJviqazfqXaL4GAl0lGRedEs=",
            "username" : "alice",
            "subscription status" : "subscribed"


        }
```

**Data Encryption:** Everything shared between the client and server is encrypted using AES. This means no one can see sensitive data (session key, game lists, searches) unless they have the AES key available to them.

**HMAC for Integrity:** HMAC (Hash-based Message Authentication Code) ensures that the data hasn't been tampered with. If anything changes unexpectedly, the system can catch it because the HMAC values won't match up.

- During session, AES-GCM's built-in authentication ensures data integrity without additional HMACs.

## <u>Session Management:</u>

**Session Creation:** A session is created when the user logins, binding the user to a unique session ID.

- AES session key
- Session expiry time

**Logout:** When the client logs out, the server deletes the AES key, ending the session. This confirms that the session can't be hijacked and that a fresh login is required next time.

**Session Timeout:** To prevent unauthorized access, the server automatically logs out users after a certain period of inactivity. If the client tries to interact after that time, they have to log back in.

## User and Subscription Management:

**User Creation:** When a new user signs up, the server creates a user object containing their username, hashed password (with salt), TOTP secret, subscription status, and HMAC key. This ensures that every user is securely registered and ready for future interactions.

- Username,
- Password hash (with salt),
- TOTP secret (for MFA),
- Subscription status (e.g., "subscribed" or "not subscribed"),
- HMAC key (for verifying challenge responses).

**Subscription Management:** The server also handles subscriptions, so users can check their current subscription status, upgrade, or downgrade based on their preferences. This helps determine what games they have access to.

## Summary:

**Confidentiality** (AES encryption),

**Integrity** (HMAC, AES-GCM),

**Authentication** (Password + TOTP),

**Replay Attack Resistance** (Nonces),

**Session Security** (unique keys, timeout, proper termination),

**Account Security** (hashed passwords, 2FA, fresh keys).