Technical Report: React Native Authentication Implementation

Executive Summary

This report documents the complete implementation of user authentication in a React Native movie application using Expo and Appwrite as the backend-as-a-service. The implementation involved creating a robust authentication flow that manages user sessions, handles secure login/logout functionality, and integrates seamlessly with Expo Router for navigation between authenticated and unauthenticated states.

Technology Stack

- **React Native**: 0.74.x with Expo SDK 51
- **Expo Router**: File-based routing system
- **Appwrite**: Backend-as-a-Service for authentication and database
- **TypeScript**: For type safety and better developer experience
- **NativeWind**: Tailwind CSS for React Native styling

Timeline and Major Milestones

1. **Initial Setup** (Day 1): Appwrite configuration and project structure
2. **Authentication Screens** (Day 1): Login and registration UI implementation
3. **Context Implementation** (Day 1-2): User state management setup
4. **Navigation Issues** (Day 2): Expo Router integration challenges
5. **Session Management** (Day 2): Proper authentication flow implementation
6. **Final Resolution** (Day 2): Working authentication with proper routing

Key Challenges Overcome

- Expo Router conditional navigation rendering issues
- Session persistence and state management complexity
- Appwrite client configuration for mobile platforms
- Authentication state synchronization across the application

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Initial Architecture Design

Original Authentication Flow

The initial design envisioned a straightforward authentication flow:

```
App Start → Check Session → Route Decision
       Session Exists → Main App (Tabs Layout)
```

```
No Session → Authentication Screens
```

Initial Assumptions About Expo Router

The original assumption was that Expo Router would handle conditional screen rendering seamlessly:

```
// Initial (problematic) approach
<Stack>
  {user ? (
    <>
      <Stack.Screen name="(tabs)" />
      <Stack.Screen name="movies/[id]" />
    </>
  ) : (
    <Stack.Screen name="(auth)" />
  )}
</Stack>
```

> **Key Assumption**: That dynamically changing Stack.Screen components would trigger proper navigation updates.

Planned State Management

The initial plan used React Context API for global authentication state: - **AuthContext**: Centralized user state and authentication methods - **AuthProvider**: Wrapper component providing auth state to the entire app - **useAuth Hook**: Custom hook for consuming authentication context

Expected Appwrite Integration Points

- User registration and login endpoints
- Session management and persistence
- JWT token handling
- Account information retrieval

Implementation Journey - Chronological Deep Dive

Phase A: Initial Setup and Configuration

Appwrite Project Configuration The Appwrite setup required creating two separate client configurations due to platform-specific requirements:

```
// lib/appWriteConfig.js - Platform-specific configuration
import { Client, Account } from 'react-native-appwrite'
import { Platform } from 'react-native'
```

```
const client = new Client()
    .setEndpoint(process.env.EXPO_PUBLIC_APPWRITE_ENDPOINT)
    .setProject(process.env.EXPO_PUBLIC_APPWRITE_PROJECT_ID)

switch(Platform.OS){
    case 'ios':
        client.setPlatform(process.env.EXPO_PUBLIC_APPWRITE_BUNDLE_ID)
        break
    case 'android':
        client.setPlatform(process.env.EXPO_PUBLIC_APPWRITE_PACKAGE_NAME)
        break
}

const account = new Account(client)
export { account }
```

Why this configuration was necessary: Appwrite requires platform-specific bundle IDs for mobile apps to properly handle sessions and security contexts.

Initial Project Structure

```
app/
   (auth)/
       _layout.tsx
       sign-in.tsx
       sign-up.tsx
   (tabs)/
       _layout.tsx
       index.tsx
       profile.tsx
       saved.tsx
   _layout.tsx
   globals.css

services/
   AuthContext.tsx
   appwrite.ts
```

Key Dependencies Installed

```
{
  "react-native-appwrite": "^0.4.0",
  "expo-router": "~3.5.23",
  "nativewind": "^2.0.11"
}
```

Dependency Rationale: - `react-native-appwrite`: Official SDK for seamless React Native integration - `expo-router`: File-based routing system that simplifies navigation structure - `nativewind`: Provides Tailwind CSS styling capabilities for consistent UI

Phase B: Authentication Flow Implementation

Initial Authentication Screens The authentication screens were implemented with form validation and error handling:

```
// app/(auth)/sign-in.tsx - Initial implementation
import { useState } from "react";
import { View, Text, TextInput, TouchableOpacity, Alert } from "react-native";
import { useAuth } from "@/services/AuthContext";

export default function SignIn() {
  const [email, setEmail] = useState("");
  const [password, setPassword] = useState("");
  const { signin, isLoading } = useAuth();

  const handleSignIn = async () => {
    if (!email || !password) {
      Alert.alert("Error", "Please fill in all fields");
      return;
    }

    try {
      await signin(email, password);
      // Expected: Automatic navigation to main app
    } catch (error: any) {
      Alert.alert("Sign In Failed", error.message || "An error occurred");
    }
  };

  return (
    <View className="flex-1 bg-primary px-6 justify-center">
      {/* Form implementation */}
    </View>
  );
}
```

Initial Routing Setup Issues The first major issue encountered was with Expo Router's conditional navigation:

```
// app/_layout.tsx - Problematic initial approach
function RootLayoutNav() {
  const { user, isLoading } = useAuth();
  if (isLoading) {
    return <LoadingScreen />;
  }

  return (
    <Stack screenOptions={{ headerShown: false }}>
      {user ? (
        // This conditional rendering caused route conflicts
        <>
          <Stack.Screen name="(tabs)" />
          <Stack.Screen name="movies/[id]" />
        </>
      ) : (
        <Stack.Screen name="(auth)" />
      )}
    </Stack>
  );
}
```

Expected Behavior: When `user` state changed, Expo Router would automatically show the appropriate screens.

Actual Behavior: - Route conflicts and "Unmatched Route" errors - Navigation getting stuck on auth screens even after successful login - Malformed URLs like `exp://192.168.1.240:8081/--/(auth)`

Initial Hypothesis: The conditional rendering would trigger Expo Router to rebuild the navigation stack and automatically route to the correct screens.

Phase C: State Management Challenges

Original AuthContext Implementation The initial AuthContext had several fundamental flaws:

```
// services/AuthContext.tsx - Problematic initial version
const AuthProvider = ({ children }: { children: React.ReactNode }) => {
  const [loading, setLoading] = useState(false);
  const [user, setUser] = useState(false); //  Hardcoded to false

  const signin = async ({ email, password }: { email: string, password: string }) => {
    setLoading(true);
    try {
      const responseSession = await account.createEmailPasswordSession(email, password);
      //  Never set user state or check current user
    } catch (error) {
      console.log(error);
    }
    //  setLoading(false) never called
  };

  //  Context provides 'loading' but layout expects 'isLoading'
  const contextData = { session, user, signin, signout };

  return (
    <AuthContext.Provider value={contextData}>
      {loading ? <LoadingScreen /> : children}
    </AuthContext.Provider>
  );
};
```

Critical Issues with This Approach:

1. **Hardcoded User State**: `setUser(false)` meant user was never considered logged in
2. **Missing Property**: Context provided `loading` but components expected `isLoading`
3. **Incomplete Authentication Flow**: Never called `getCurrentUser()` after successful login
4. **Loading State Bug**: `setLoading(false)` was never called, causing infinite loading
5. **No Session Persistence**: No check for existing sessions on app startup

Why This Seemed Like a Good Idea Initially: The assumption was that manually setting user state after successful authentication would be sufficient. However, this approach ignored Appwrite's session management system and the need to verify authentication state on app startup.

Problems This Caused: - Users appeared logged out even with valid sessions - Authentication state was never properly synchronized - Loading states prevented the app from functioning - No way to detect existing sessions after app restart

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Error Analysis and Troubleshooting

Major Error #1: Authentication State Not Detected

Error Symptoms:

```
LOG  AuthContext: getCurrentUser result: {"email": "ayda37231@gmail.com", "user": true}
LOG  AuthContext: User found, setting as logged in
LOG  RootLayout: Current state: {"hasUser": true, "isLoading": false}
LOG  RootLayout: Rendering screens, showing: main app
```

But user still saw authentication screens instead of main app.

Root Cause Analysis: The authentication state was correctly detected and set, but Expo Router's conditional screen rendering wasn't responding to state changes properly.

Debugging Steps Taken: 1. Added extensive console logging to track state changes 2. Verified Appwrite session was valid using `account.get()` 3. Confirmed user state was properly set in context 4. Traced navigation rendering logic

Failed Solution Attempts:

```
// Attempt 1: Manual router navigation
useEffect(() => {
  if (!isLoading) {
    if (user) {
      router.replace("/(tabs)/");
    } else {
      router.replace("/(auth)/sign-up");
    }
  }
}, [user, isLoading]);
```

Why it failed: Created route conflicts and malformed URLs.

```
// Attempt 2: Force re-render with keys
<Stack key={user ? 'authenticated' : 'unauthenticated'}>
  {/* screens */}
</Stack>
```

Why it failed: Still didn't resolve the fundamental routing issue.

Major Error #2: Session Management Problems

Error Message:

```
[AppwriteException: User (role: guests) missing scope (account)]
```

Code That Caused the Error:

```
// Two different client configurations causing session conflicts
// services/appwrite.ts
const client = new Client()
    .setEndpoint('https://fra.cloud.appwrite.io/v1') //  Hardcoded endpoint
    .setProject(process.env.EXPO_PUBLIC_APPWRITE_PROJECT_ID!)

// lib/appWriteConfig.js
const client = new Client()
    .setEndpoint(process.env.EXPO_PUBLIC_APPWRITE_ENDPOINT) //  Environment variable
    .setProject(process.env.EXPO_PUBLIC_APPWRITE_PROJECT_ID)
```

Hypothesis: Different client configurations were creating session scope conflicts.

Solution: Unified both client configurations to use the same environment variables and platform-specific settings.

Major Error #3: Navigation After Authentication

Error: Users successfully authenticated but remained on auth screens.

Stack Trace Investigation:

```
LOG  AuthContext: Signin complete, auth state refreshed
LOG  RootLayout: Current state: {"hasUser": true, "userEmail": "user@example.com"}
LOG  RootLayout: Rendering screens, showing: main app
```

The Problem: State was correct, but Expo Router wasn't navigating.

Research Conducted: - Expo Router documentation on conditional navigation - Stack Overflow: "Expo Router conditional screens not working" - GitHub issues on expo-router repository - React Navigation migration guides

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Solution Evolution

Revised Authentication Flow Architecture

The final working solution used a redirect-based approach rather than conditional screen rendering:

```
App Start → Index Screen → Auth Check → Redirect
       User Exists → <Redirect href="/(tabs)" />
       No User → <Redirect href="/(auth)/sign-up" />
```

Final Working Routing Implementation

```
// app/_layout.tsx - Final working solution
function RootLayoutNav() {
  const { user, isLoading } = useAuth();

  if (isLoading) {
    return (
      <View className="flex-1 justify-center items-center bg-primary">
        <Text className="text-white">Loading...</Text>
      </View>
    );
  }

  // Render all screens, let index.tsx handle redirects
  return (
    <>
      <StatusBar hidden={true} />
      <Stack screenOptions={{ headerShown: false }}>
        <Stack.Screen name="index" />
        <Stack.Screen name="(tabs)" />
        <Stack.Screen name="(auth)" />
        <Stack.Screen name="movies/[id]" />
      </Stack>
    </>
  );
}

// app/index.tsx - Redirect logic
export default function Index() {
  const { user, isLoading } = useAuth();

  if (isLoading) {
    return <LoadingScreen />;
  }

  if (user) {
    return <Redirect href="/(tabs)" />;
  } else {
    return <Redirect href="/(auth)/sign-up" />;
  }
}
```

Why This Approach Succeeded: 1. **Static Screen Declaration**: All screens are declared upfront, eliminating conditional rendering issues 2. **Centralized Routing Logic**: Authentication-based routing is handled in one place 3. **Expo Router Compatibility**: Uses `<Redirect>` component designed for this purpose 4. **Predictable Navigation**: Clear, deterministic routing based on authentication state

Improved State Management Solution

The final AuthContext implementation addressed all previous issues:

```
// services/AuthContext.tsx - Final working version
const AuthProvider = ({ children }: { children: React.ReactNode }) => {
  const [isLoading, setIsLoading] = useState(true); //  Correct property name
  const [user, setUser] = useState(null); //  Proper initial state

  //  Check for existing session on app startup
  useEffect(() => {
    checkCurrentUser();
  }, []);

  const checkCurrentUser = async () => {
    try {
      setIsLoading(true);
      const currentUser = await getCurrentUser();
      if (currentUser) {
        setUser(currentUser);
      } else {
        setUser(null);
      }
    } catch (error) {
      setUser(null);
    } finally {
      setIsLoading(false); //  Always reset loading state
    }
  };

  const signin = async (email: string, password: string) => {
    try {
      await signIn(email, password);
      //  Refresh auth state instead of manual user setting
      await checkCurrentUser();
    } catch (error) {
      setUser(null);
      throw error;
    }
  };

  //  Proper context data structure
  const contextData = {
    signin,
    signup,
    signout: logout,
    refreshAuthState: checkCurrentUser,
    isLoading,
    user
  };

  return (
    <AuthContext.Provider value={contextData}>
      {children} {/*  No conditional rendering in provider */}
    </AuthContext.Provider>
  );
};
```

Key Improvements: 1. **Session Persistence**: Checks for existing sessions on app startup 2. **Proper Loading Management**: `isLoading` state properly managed and reset 3. **Centralized User State**: `checkCurrentUser()` function handles all user state updates 4. **Error Resilience**: Proper error handling and state cleanup 5. **Consistent API**: All authentication methods use the same pattern

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Appwrite-Specific Considerations

Session Management Implementation

Appwrite handles sessions through JWT tokens stored securely on the device. The implementation leverages this:

```
// services/appwrite.ts - Session management
export const getCurrentUser = async() => {
  try {
    const currentUser = await account.get();
    return currentUser;
  } catch (error) {
    return null; // No valid session
  }
}

export const signOut = async() => {
  try {
    await account.deleteSession('current');
    return true;
  } catch (error) {
    throw error;
  }
}
```

Platform-Specific Configuration Discovery

A critical discovery was that Appwrite requires platform-specific bundle IDs:

```
// This configuration is essential for mobile sessions
switch(Platform.OS){
  case 'ios':
    client.setPlatform(process.env.EXPO_PUBLIC_APPWRITE_BUNDLE_ID)
    break
  case 'android':
    client.setPlatform(process.env.EXPO_PUBLIC_APPWRITE_PACKAGE_NAME)
    break
}
```

Why This Was Necessary: Without platform-specific configuration, sessions would fail with scope errors on mobile devices.

Appwrite SDK Quirks Discovered

1. **Session Timing**: Small delay needed between `createEmailPasswordSession` and `account.get()`
2. **Error Handling**: Appwrite throws exceptions for both network errors and authentication failures
3. **Session Persistence**: Sessions persist automatically across app restarts when properly configured

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Authentication Logic Deep Dive

Login Flow Implementation

```
const signin = async (email: string, password: string) => {
  try {
    console.log("AuthContext: Attempting signin...");

    // Step 1: Create Appwrite session
    const session = await signIn(email, password);
    console.log("AuthContext: signIn successful, session created:", !!session);

    // Step 2: Refresh authentication state
    console.log("AuthContext: Refreshing auth state after successful signin");
    await checkCurrentUser();

    console.log("AuthContext: Signin complete, auth state refreshed");
  } catch (error) {
    console.log("AuthContext: Sign in error:", error);
    setUser(null);
    throw error;
  }
};
```

Key Decision: Using `checkCurrentUser()` instead of manually setting user state ensures consistency with Appwrite's session management.

Registration Flow Logic

```
const signup = async (email: string, password: string, name: string) => {
  try {
    console.log("AuthContext: Attempting signup...");

    // Step 1: Create Appwrite account
    await createAccount(email, password, name);
    console.log("AuthContext: Account created, signing in...");
    // Step 2: Automatically sign in the new user
    await signIn(email, password);
    console.log("AuthContext: Signed in after signup, refreshing auth state");

    // Step 3: Refresh authentication state
    await checkCurrentUser();
    console.log("AuthContext: Signup complete, auth state refreshed");
  } catch (error) {
    console.log("AuthContext: Sign up error:", error);
    setUser(null);
    throw error;
  }
};
```

Design Decision: Automatic sign-in after registration provides better user experience by eliminating an extra login step.

Session Persistence Logic

```
// Check for existing session on app startup
useEffect(() => {
  checkCurrentUser();
}, []);

const checkCurrentUser = async () => {
  try {
    setIsLoading(true);
    const currentUser = await getCurrentUser();
    if (currentUser) {
      setUser(currentUser);
      console.log("AuthContext: User found, setting as logged in");
    } else {
      setUser(null);
      console.log("AuthContext: No user found, setting as logged out");
    }
  } catch (error) {
    console.log("AuthContext: Error checking user:", error);
    setUser(null);
  } finally {
    setIsLoading(false);
  }
};
```

Security Consideration: The app automatically checks for valid sessions on startup but gracefully handles cases where sessions have expired or been revoked.

Performance Considerations in Implementation

Loading States Strategy

```
// Three-tier loading state management
if (isLoading) {
  return (
    <View className="flex-1 justify-center items-center bg-primary">
      <Text className="text-white">Loading...</Text>
    </View>
  );
}
```

Performance Benefit: Prevents UI flicker and provides user feedback during authentication checks.

Session Caching Strategy

Appwrite handles session caching automatically, but the implementation includes: - **Minimal API Calls**: `getCurrentUser()` only called when necessary - **State Synchronization**: User state updated only when authentication state changes - **Error Recovery**: Graceful handling of expired sessions

Memory Leak Prevention

```
const useAuth = () => {
  const context = useContext(AuthContext);
  if (context === undefined) {
    throw new Error('useAuth must be used within an AuthProvider');
  }
  return context;
};
```

Memory Safety: Proper context usage prevents memory leaks and ensures components unmount cleanly.

Testing and Validation Process

Manual Testing Scenarios

1. **Cold App Start**: Verify session detection on app launch
2. **Registration Flow**: Complete user registration and automatic login

3. **Login Flow**: Existing user authentication and navigation
4. **Logout Flow**: Session cleanup and navigation to auth screens
5. **Session Expiry**: Handling of expired sessions
6. **Network Errors**: Authentication failure handling

Edge Cases Discovered

1. **Rapid State Changes**: User quickly logging in/out could cause race conditions
2. **Network Interruption**: Authentication requests failing mid-process
3. **Invalid Credentials**: Proper error messaging for failed authentication
4. **Session Conflicts**: Multiple authentication attempts in sequence

Debugging Techniques That Proved Effective

1. **Console Logging Strategy**:

```
console.log("RootLayout: Current state:", {
  isLoading,
  hasUser: !!user,
  userEmail: user?.email
});
```

2. **State Tracking**: Logging state changes at each step of authentication flow
3. **Network Monitoring**: Tracking Appwrite API calls and responses
4. **Navigation Debugging**: Logging route changes and navigation attempts

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Lessons Learned

Key Insights About Expo Router Behavior

> **Critical Discovery**: Expo Router's conditional screen rendering doesn't work reliably for authentication flows. The redirect-based approach using an index screen is much more reliable.

React Native Authentication Patterns

1. **Context Over Redux**: For authentication state, React Context provides sufficient performance with less complexity
2. **Session-First Design**: Let the backend (Appwrite) handle session management; don't try to replicate it in the frontend
3. **Centralized Auth Logic**: Keep all authentication logic in one context/service rather than distributing it across components

Appwrite Integration Discoveries

1. **Platform Configuration Critical**: Mobile apps require platform-specific bundle ID configuration
2. **Session Timing**: Small delays may be needed between session creation and user data retrieval

3. **Error Handling**: Appwrite exceptions need careful handling to provide good user experience

Technical Concepts That Became Clear

Initially Confusing: Why manual state setting after authentication seemed logical but caused issues.

Understanding Gained: Authentication is inherently asynchronous and stateful. Trying to manually manage what the backend already handles creates complexity and bugs. It's better to query the authoritative source (Appwrite) for authentication state.

Critical Knowledge: The combination of proper session persistence, correct routing patterns, and centralized state management is essential for a working authentication system.

Appendices

Appendix A: Complete package.json

```
{
  "name": "tutorial_movie_app",
  "main": "expo-router/entry",
  "version": "1.0.0",
  "scripts": {
    "start": "expo start",
    "android": "expo start --android",
    "ios": "expo start --ios",
    "web": "expo start --web"
  },
  "dependencies": {
    "expo": "~51.0.28",
    "expo-router": "~3.5.23",
    "react": "18.2.0",
    "react-native": "0.74.5",
    "react-native-appwrite": "^0.4.0",
    "nativewind": "^2.0.11",
    "tailwindcss": "3.3.0"
  },
  "devDependencies": {
    "@babel/core": "^7.20.0",
    "@types/react": "~18.2.45",
    "@types/react-native": "^0.72.8",
    "typescript": "~5.3.3"
  }
}
```

Appendix B: Environment Configuration

```
# .env structure
EXPO_PUBLIC_APPWRITE_ENDPOINT=https://fra.cloud.appwrite.io/v1
EXPO_PUBLIC_APPWRITE_PROJECT_ID=your_project_id
EXPO_PUBLIC_APPWRITE_DATABASE_ID=your_database_id
EXPO_PUBLIC_APPWRITE_COLLECTION_ID=your_collection_id
EXPO_PUBLIC_APPWRITE_BUNDLE_ID=com.yourcompany.yourapp
EXPO_PUBLIC_APPWRITE_PACKAGE_NAME=com.yourcompany.yourapp
```

Appendix C: Debugging Commands Used

```
# Start Expo with clear cache
npx expo start -c

# View detailed logs
npx expo start --verbose

# Check Expo Router structure
npx expo customize metro.config.js

# Validate app configuration
npx expo config
```

Appendix D: External Resources

- Expo Router Documentation
- Appwrite React Native SDK
- React Context API Best Practices
- Stack Overflow: Expo Router Authentication

Appendix E: Technical Glossary

- **Session Persistence**: The ability for user authentication to survive app restarts
- **Conditional Navigation**: Showing different screens based on application state
- **Context Provider**: React pattern for sharing state across component tree
- **JWT Token**: JSON Web Token used for secure authentication
- **Bundle ID**: Unique identifier for mobile applications
- **Route Conflict**: When navigation system cannot resolve which screen to display

- **State Synchronization**: Keeping authentication state consistent across the application

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Final Note: This implementation demonstrates that successful authentication in React Native requires understanding the interplay between routing, state management, and backend session handling. The key insight is that trying to over-engineer the frontend often creates more problems than letting the backend service (Appwrite) handle what it's designed to do, while keeping the frontend focused on state synchronization and user experience.