

# Dynamic Portfolio Dashboard – Challenges & Solutions

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**Tech Stack:** Next.js (React), TypeScript, Node.js, Tailwind CSS

## 1. Project Overview

The goal of this assignment was to build a **dynamic portfolio dashboard** that displays real-time stock market data such as CMP, Gain/Loss, P/E Ratio, and Earnings. The application required integration with **Yahoo Finance** and **Google Finance**, both of which do not provide official public APIs.

To address this, I designed a **full-stack architecture** using Next.js, where all external data fetching and business logic are handled on the server side, and the frontend remains lightweight and focused only on rendering.

## 2. Key Challenges Faced & Solutions

### Challenge 1: No Official APIs for Yahoo & Google Finance

#### **Problem:**

Yahoo Finance and Google Finance do not expose stable, official APIs. Direct client-side access is insecure and prone to rate limits or IP blocking.

#### **Solution:**

- Used **Node.js (Next.js API routes)** as a backend layer.
- Integrated:
  - `yahoo-finance2` (unofficial library) for CMP.
  - `axios + cheerio` scraping for Google Finance P/E ratio and earnings.
- Ensured **all third-party calls happen server-side only**.

#### **Outcome:**

Improved security, better control over failures, and compliance with assignment constraints.

### Challenge 2: TypeScript Issues with Unofficial Libraries

#### **Problem:**

`yahoo-finance2` has incomplete or inconsistent TypeScript typings, causing errors like missing properties.

#### **Solution:**

- Avoid using `any`.

- Defined a **minimal domain-specific type** containing only required fields (e.g., `regularMarketPrice`).
- Explicitly cast the response to this safe type.

**Outcome:**

Maintained type safety while working with unreliable third-party typings.

## Challenge 3: Rate Limiting & Performance Issues

**Problem:**

Frequent polling (every 15 seconds) could easily hit rate limits of unofficial data sources.

**Solution:**

- Implemented an **in-memory cache with TTL (15 seconds)** on the backend.
- Backend checks cache before calling external sources.
- Frontend polling + backend caching work together efficiently.

**Outcome:**

Reduced external API calls, improved response time, and avoided blocking risks.

## Challenge 4: Partial Failures & Data Reliability

**Problem:**

If one stock or one external source fails, the entire portfolio should not break.

**Solution:**

- Implemented **per-stock error isolation** using safe wrappers.
- If Yahoo or Google fails for a single stock, fallback values are used.
- Added **last-known-good cache fallback** when the entire fetch fails.

**Outcome:**

The dashboard remains usable even during partial or complete data failures.

## Challenge 5: Mixing Business Logic with UI Logic

**Problem:**

Initially, sector-wise aggregation and portfolio calculations were happening on the frontend, increasing complexity and re-renders.

**Solution:**

- Moved **all business logic** (portfolio calculations, sector aggregation) to the backend.
- Backend now returns:
  - Stock-level data
  - Pre-aggregated sector summaries
- Frontend components are now **purely presentational**.

**Outcome:**

Cleaner frontend, reusable API, and better separation of concerns.

## Challenge 6: Real-Time Updates Without Over-Engineering

**Problem:**

Real-time updates were required, but WebSockets would add unnecessary complexity.

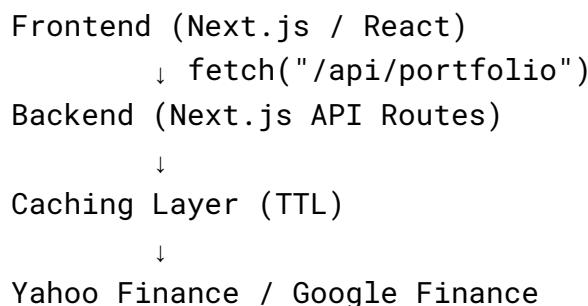
**Solution:**

- Implemented **client-side polling (15 seconds)** using `setInterval`.
- Combined with backend caching for efficiency.
- Proper cleanup using `clearInterval` to avoid memory leaks.

**Outcome:**

Achieved real-time behavior with a simple, production-friendly approach.

## 3. Architecture Summary



## 4. Final Outcome

- Fully functional **dynamic portfolio dashboard**
- Secure and scalable architecture
- Graceful error handling and fallbacks
- Clean separation of frontend and backend responsibilities
- Interview-ready explanations for all major design decisions

## 5. Conclusion

This assignment helped me apply real-world engineering practices such as handling unreliable external APIs, designing fault-tolerant systems, and balancing performance with simplicity. The final solution prioritizes **stability, maintainability, and user experience**, which are critical for financial applications.