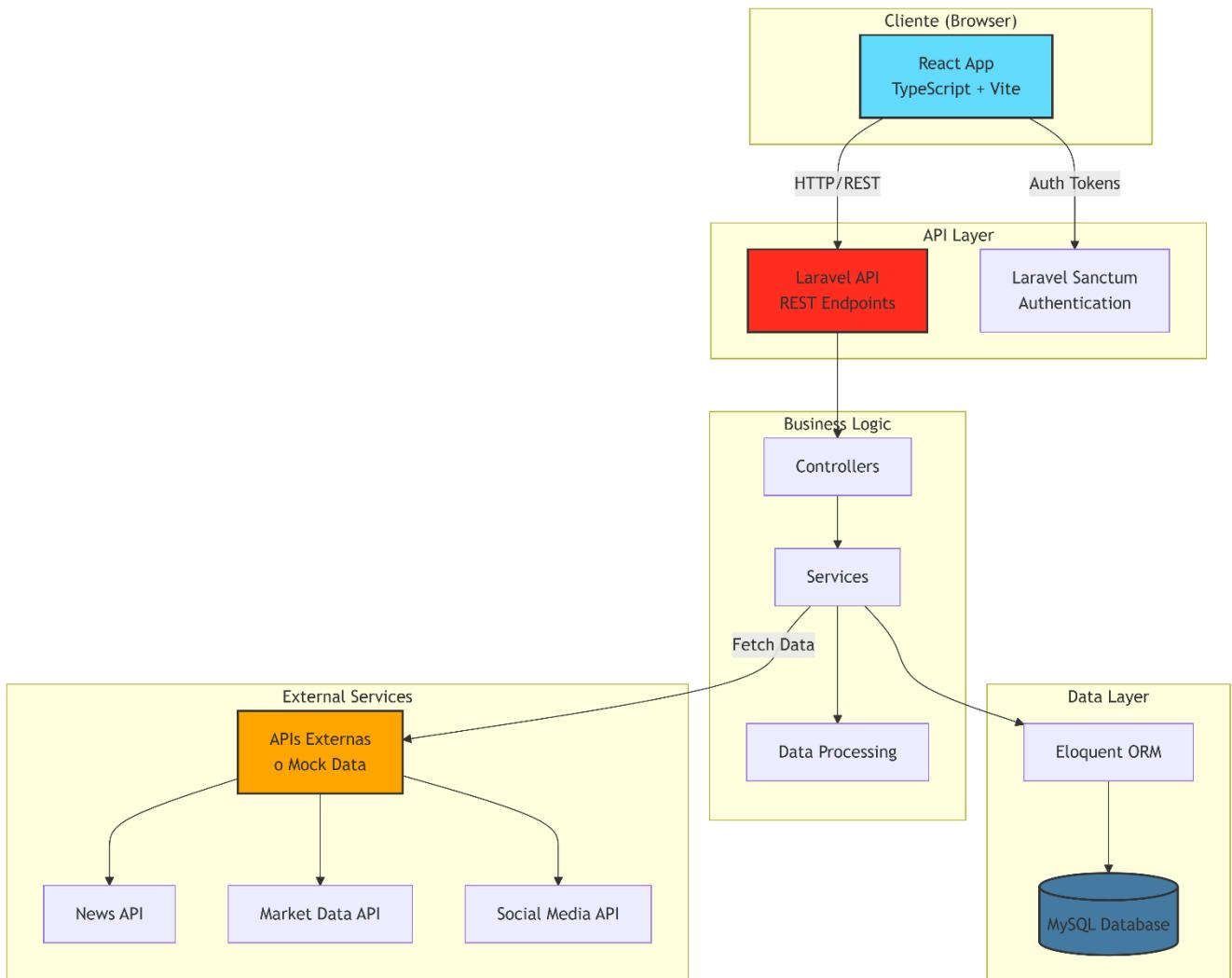


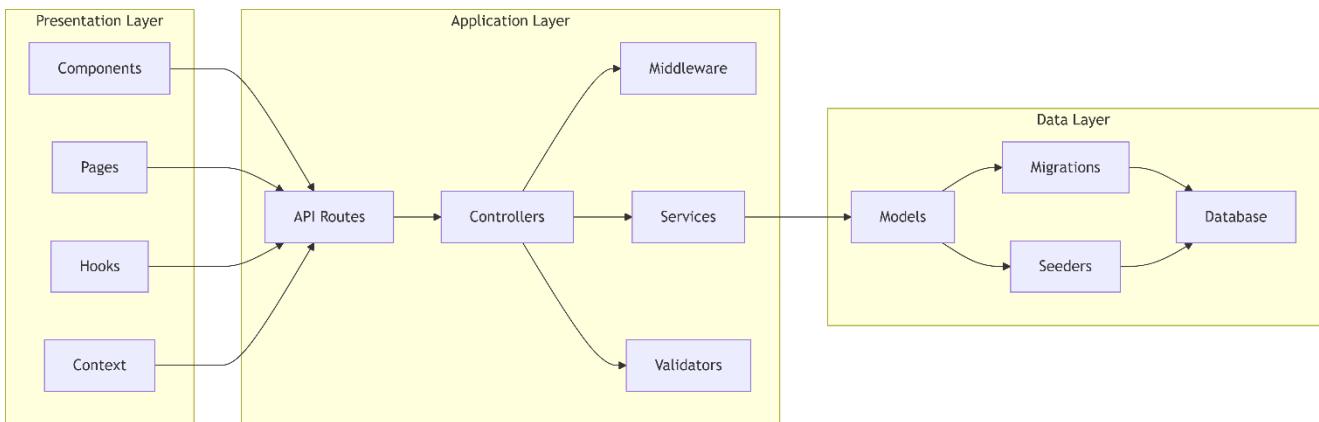
## Arquitectura del Sistema

### Plataforma de Inteligencia y Monitoreo para PYMEs

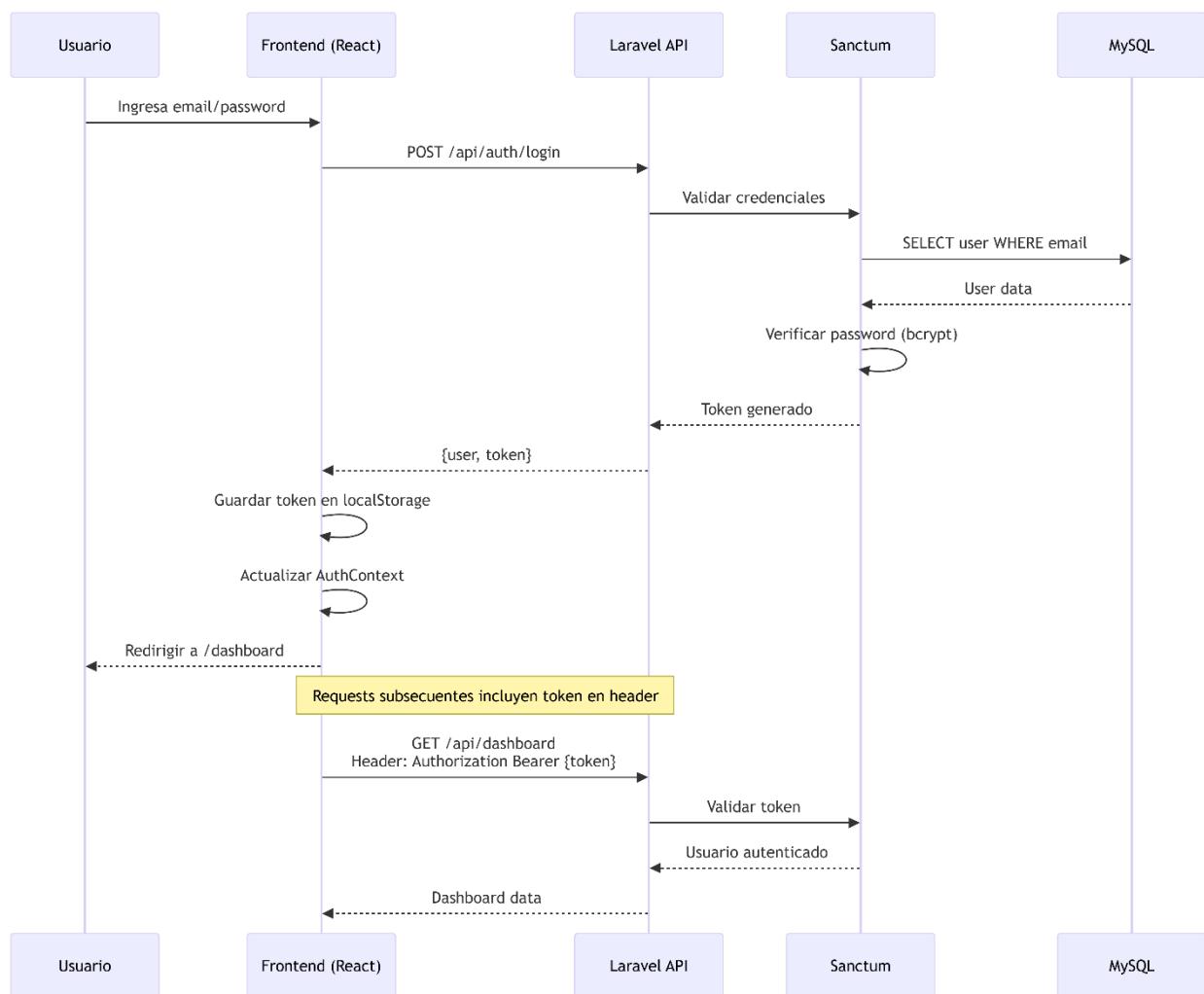
#### 1. Diagrama de Arquitectura General



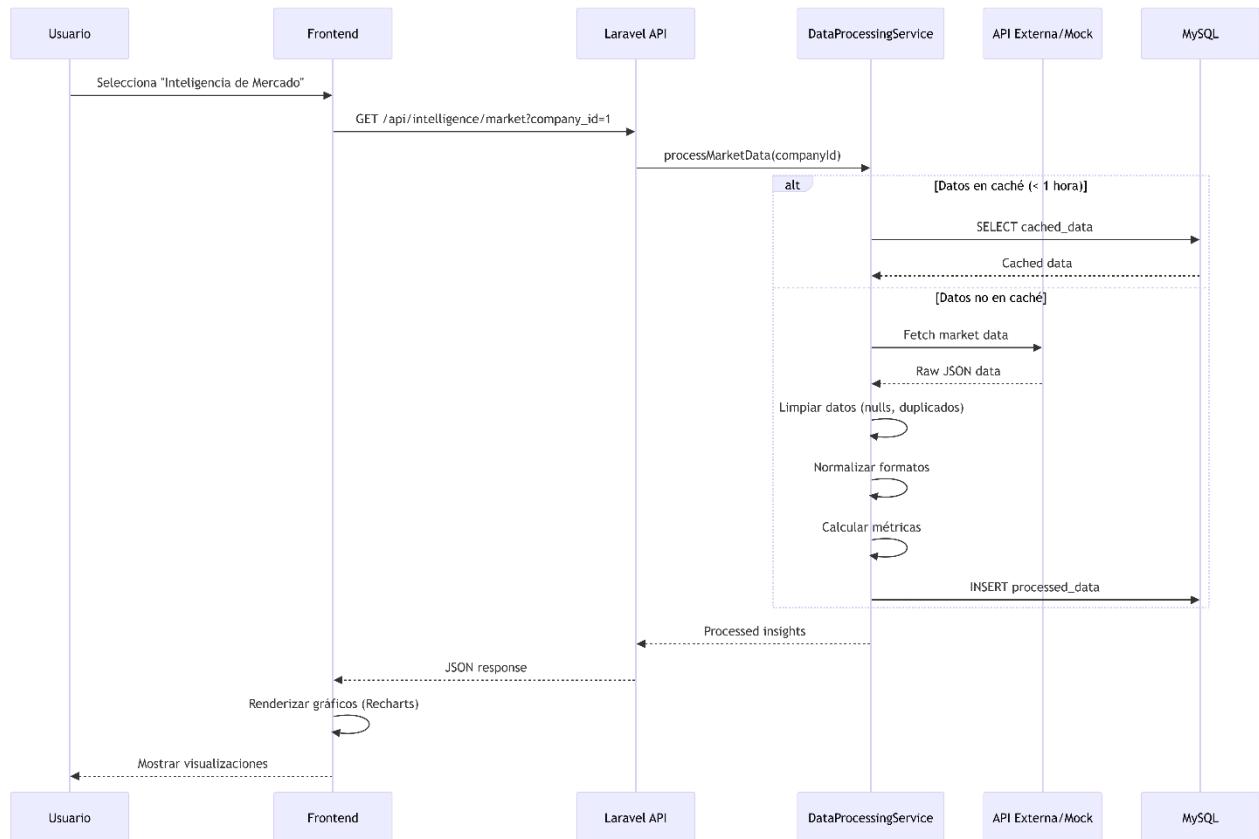
## 2. Arquitectura de 3 Capas Detallada



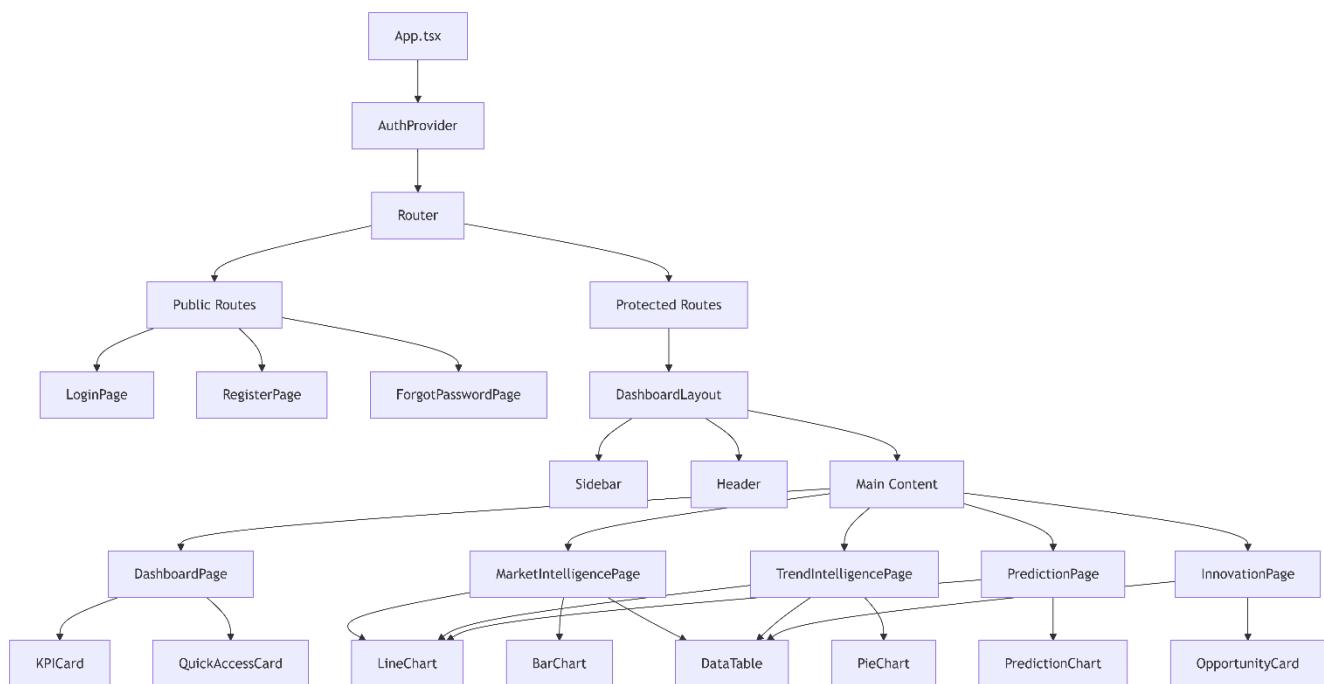
## 3. Flujo de Autenticación



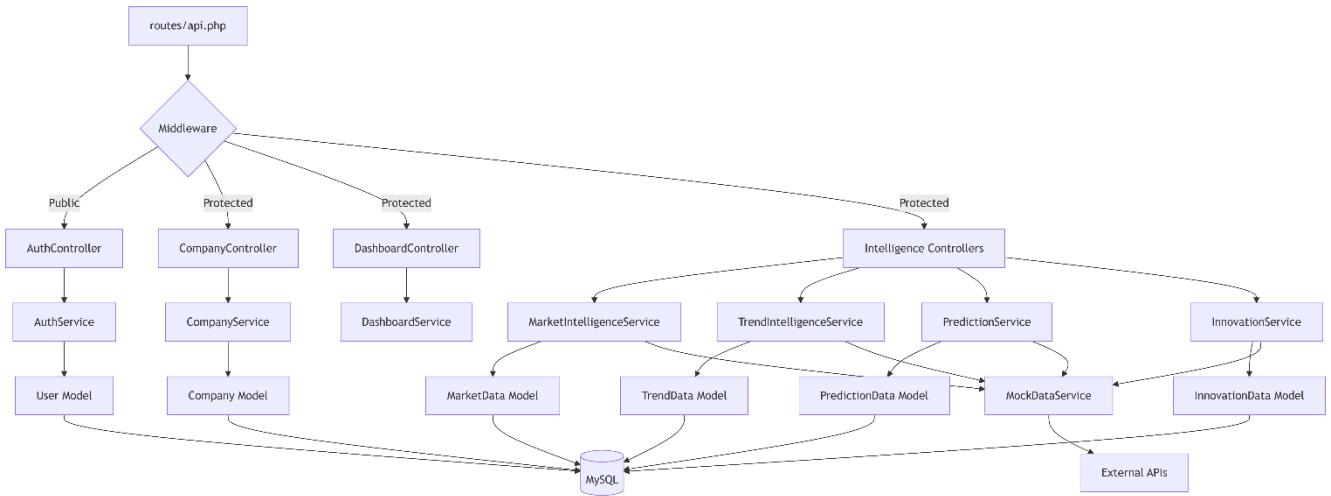
## 4. Flujo de Datos de Inteligencia



## 5. Estructura de Componentes Frontend



## 6. Estructura de Backend (Laravel)



## 7. Patrones de Diseño Utilizados

### 7.1 Repository Pattern (Opcional)

Controller → Service → Repository → Model → Database

**Beneficio:** Abstira acceso a datos, facilita testing

### 7.2 Service Layer Pattern

Controller → Service (Business Logic) → Model

**Beneficio:** Separa lógica de negocio de controllers

### 7.3 Provider Pattern (Frontend)

App → AuthProvider → Components

**Beneficio:** Estado global sin prop drilling

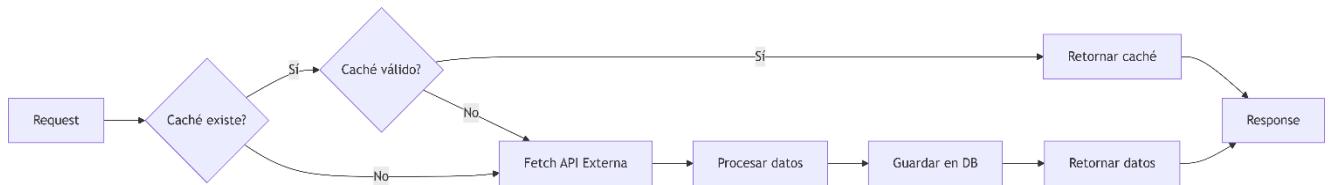
## 7.4 Custom Hooks Pattern

Component → useAuth() → AuthContext

Component → useIntelligence() → API Service

**Beneficio:** Reutilización de lógica

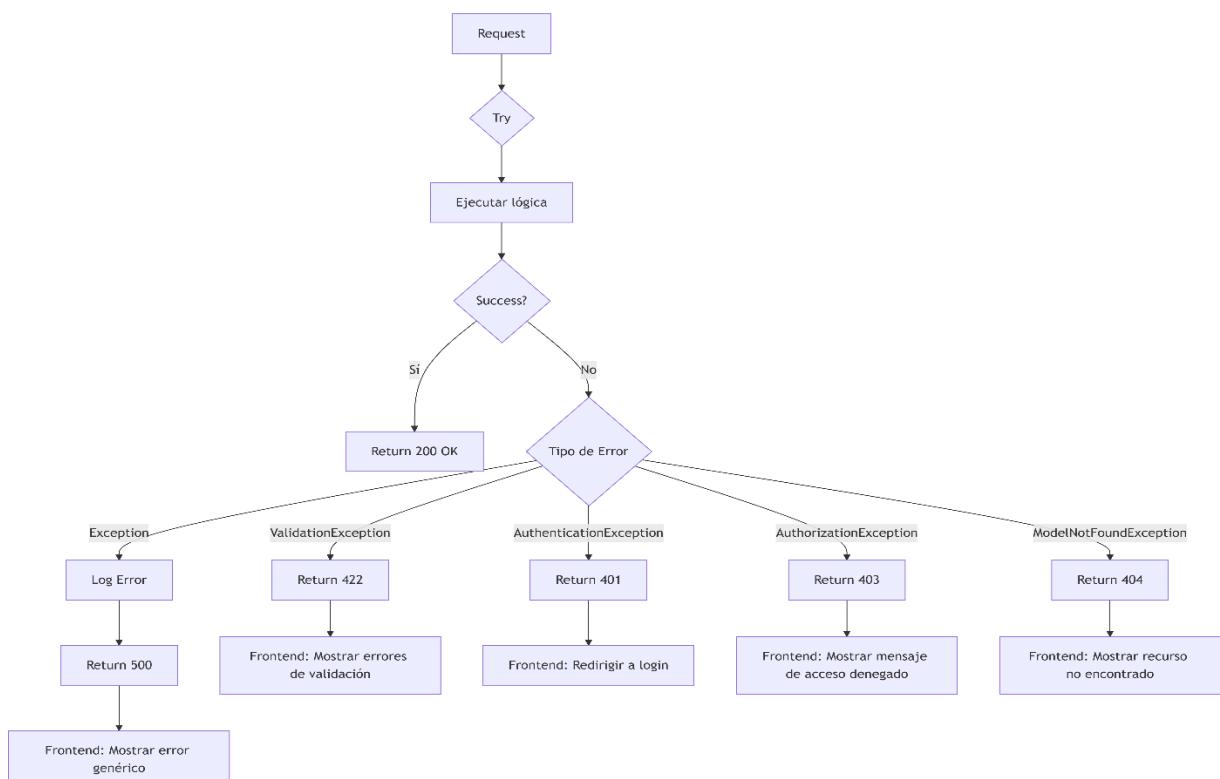
## 8. Estrategia de Caché



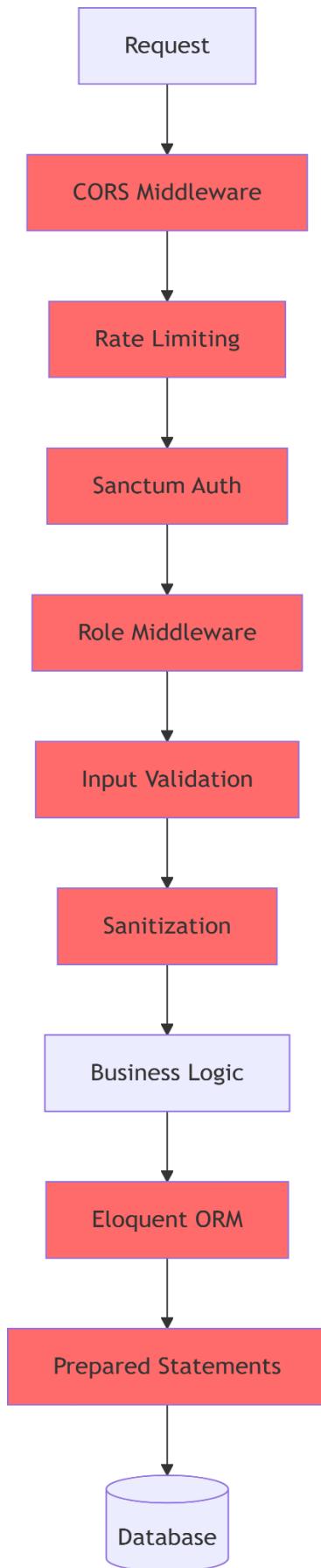
**Tiempos de caché:**

- Market Intelligence: 1 hora
- Trend Intelligence: 30 minutos
- Prediction: 6 horas
- Innovation: 24 horas

## 9. Manejo de Errores



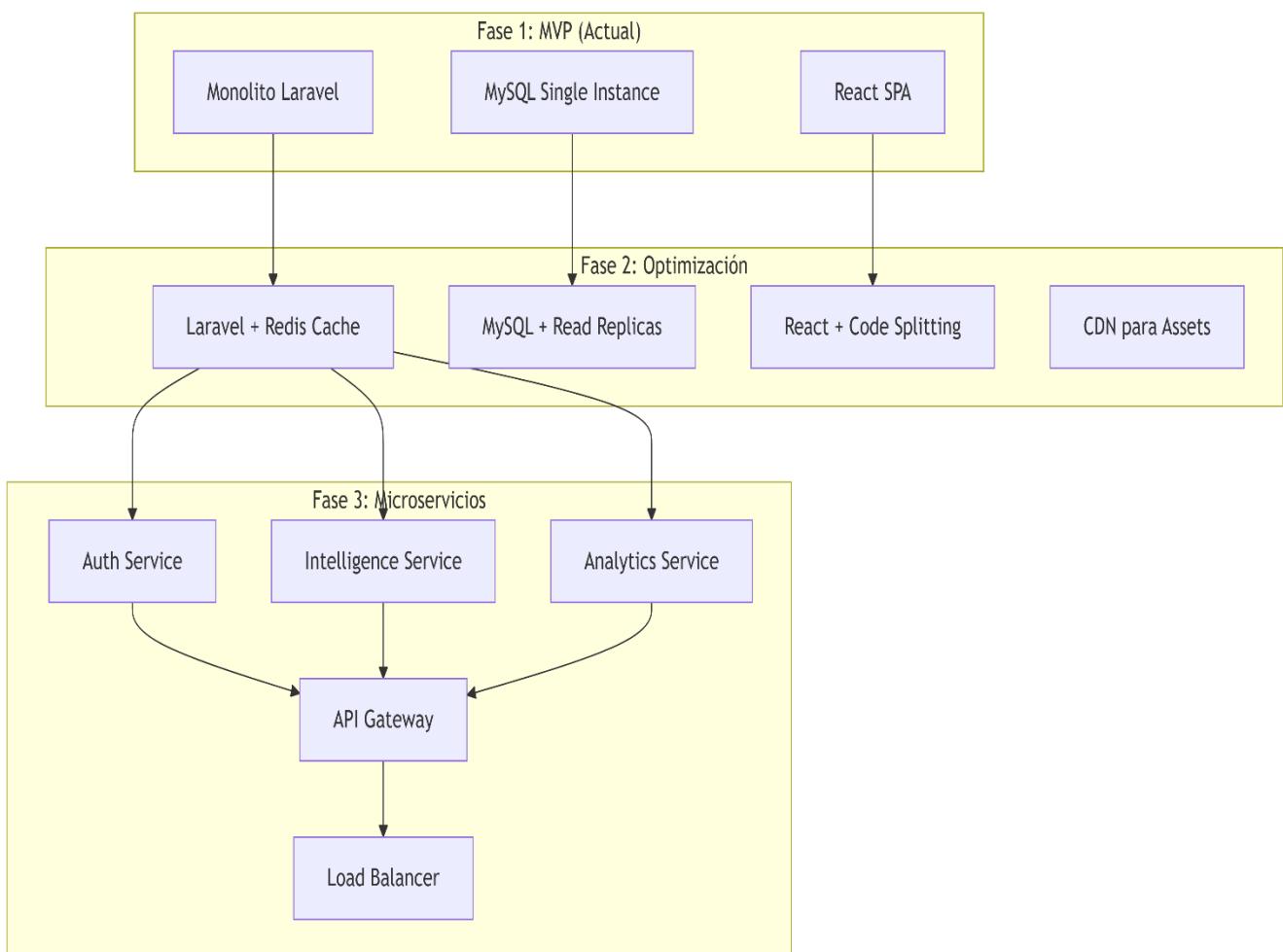
## 10. Seguridad en Capas



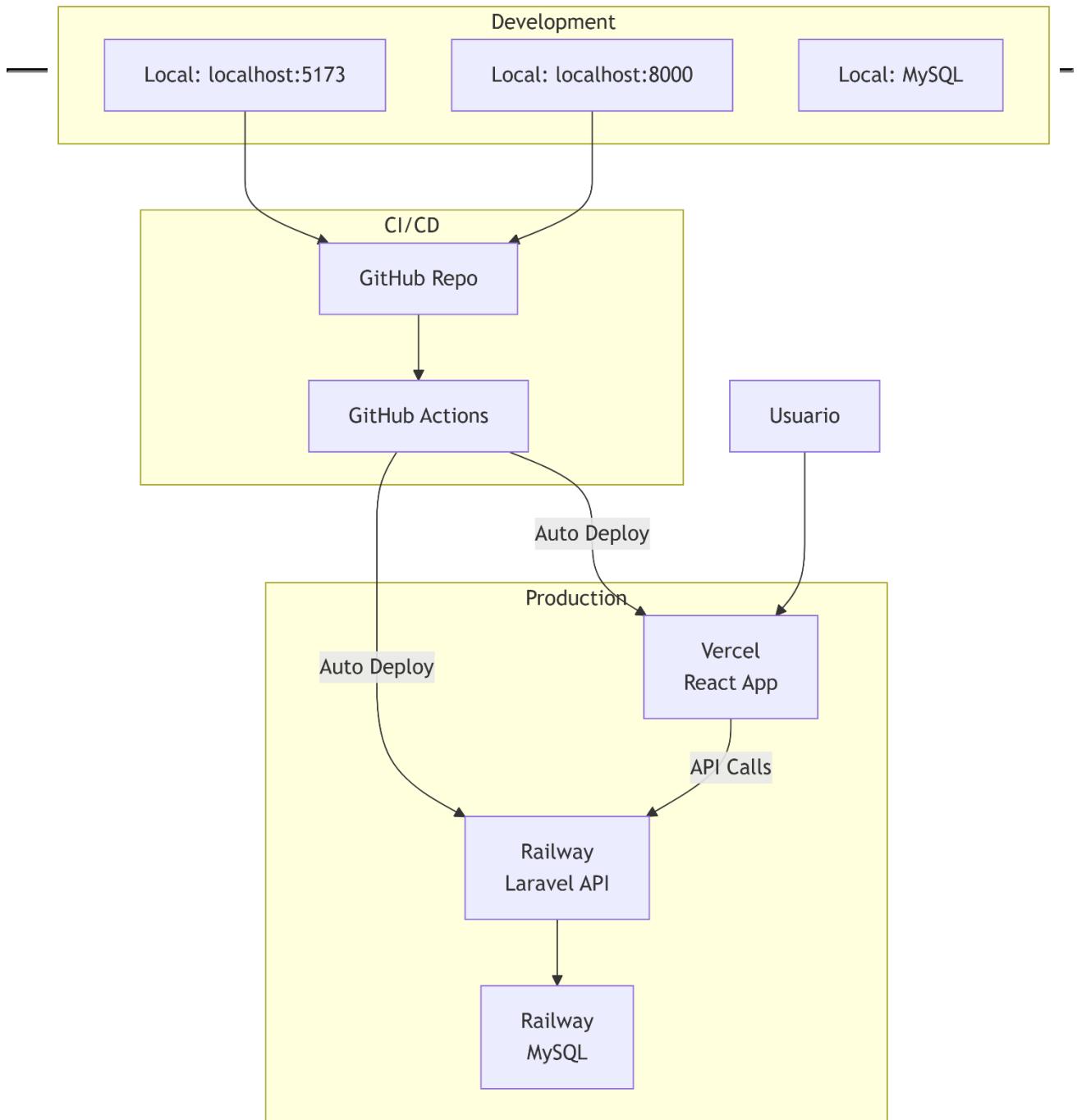
## Capas de seguridad

- **CORS:** Solo dominios permitidos
- **Rate Limiting:** Prevenir abuso
- **Authentication:** Validar identidad
- **Authorization:** Validar permisos
- **Validation:** Validar formato de datos
- **Sanitization:** Limpieza de inputs (XSS)
- **ORM:** Prevenir SQL Injection
- **Prepared Statements:** Seguridad adicional

## 11. Escalabilidad Futura



## 12. Deployment Architecture



### Flujo de Deploy:

1. Push a **main** branch
2. GitHub Actions ejecuta tests
3. Si tests pasan, deploy automático
4. Vercel despliega fronten
5. Railway despliega backend 6.
- Railway ejecuta migraciones

## 13. Consideraciones de Performance

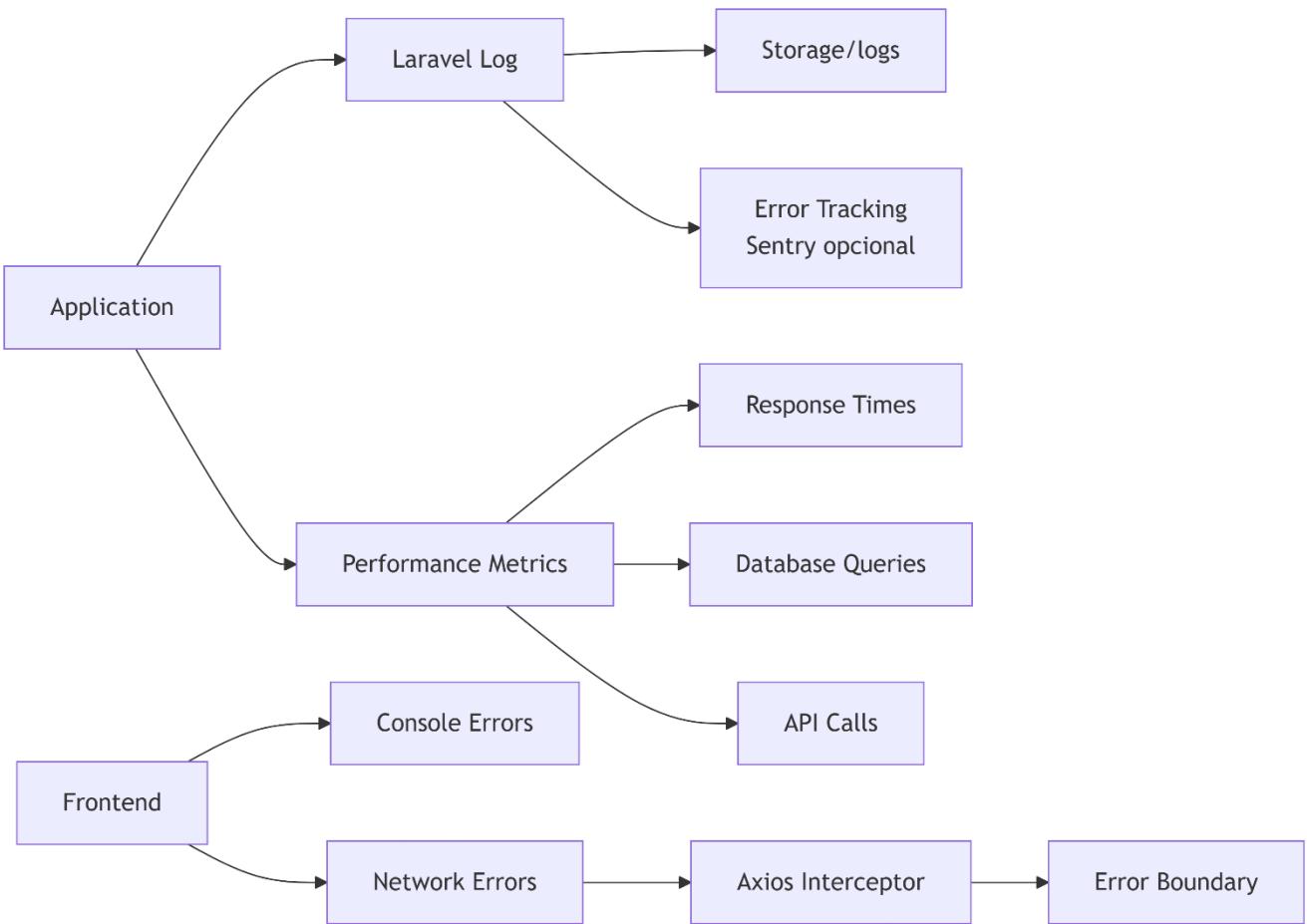
### Frontend

- **Code Splitting:** Lazy loading de rutas
- **Memoización:** React.memo, useMemo, useCallback
- **Bundle Optimization:** Vite tree-shaking
- **Image Optimization:** WebP, lazy loading
- **Debouncing:** En búsquedas y filtros

### Backend

- **Query Optimization:** Eager loading (with())
- **Indexing:** Índices en columnas de búsqueda
- **Pagination:** Limitar resultados
- **Caching:** Redis para datos frecuentes (futuro)
- **API Rate Limiting:** Prevenir sobrecarga

## 14. Monitoreo y Logging



## 15. Tecnologías y Versiones

Componente	Tecnología	Versión
Frontend Framework	React	18.x
Frontend Language	TypeScript	5.x
Build Tool	Vite	5.x
Styling	Tailwind CSS	3.x
Charts	Recharts	2.x
Backend Framework	Laravel	11.x

Componente	Tecnología	Versión
Backend Language	PHP	8.2+
Database	MySQL	8.0
Authentication	Laravel Sanctum	4.x
HTTP Client	Axios	1.x