Technical Documentation: NFC Transaction System

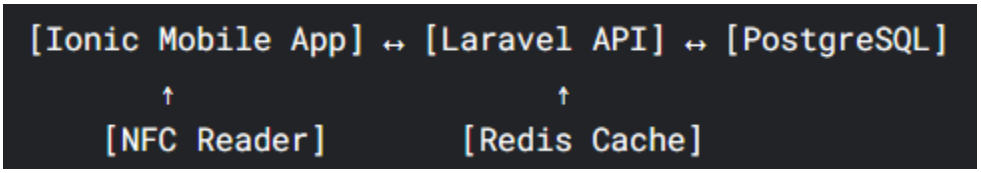
1. System Architecture

1.1 Overview

The NFC Transaction System is a full-stack application consisting of:

- **Frontend**: Ionic 7 + Angular 17 mobile app
- **Backend**: Laravel 10 REST API
- **Database**: PostgreSQL
- **Cache**: Redis

1.2 Architecture Diagram



1.3 Component Breakdown

Component	Technology	Responsibility
Mobile UI	Ionic/Angular	NFC scanning, transaction display
API Layer	Laravel	Business logic, authentication
Data Storage	PostgreSQL	Transaction records, user data
Caching	Redis	Session management, rate limiting
Security	JWT + Middleware	Authentication, data validation

2. Security Considerations

2.1 Authentication

- **JWT Authentication with 1-hour expiration**
- **Refresh token rotation**
- **Token blacklisting for logout functionality**

2.3 NFC-Specific Security

- **Device ownership verification before transaction processing**
- **NFC tag ID whitelisting**
- **5-second replay attack prevention window**

3. Performance Optimizations

3.1 Backend Optimizations

Technique	**Implementation Example**	**Benefit**
Database Indexing	$table->index('user_id')	Faster transaction queries
Query Caching	Cache::remember()	Reduced DB load
Pagination	->paginate(10)	Lower memory usage
Lazy Loading	->select(['id','amount'])	Reduced data transfer

3.2 Frontend Optimizations

Technique	**Implementation Example**
Lazy Loading	Ionic ion-img for images
Virtual Scrolling	ion-list [virtualScroll]
Caching Strategies	Ionic Storage + RxJS

4. Key Technical Decisions

4.1 Why Ionic + Angular?

- **Cross-platform support (iOS/Android/Web)**
- **Native NFC plugin compatibility**
- **Type Safety with Angular**
- **Maintainability of component-based architecture**

4.2 Why Laravel?

- **Eloquent ORM for safe database operations**
- **Built-in API resources for clean JSON responses**
- **Queue system for background processing**