Petfolio

Final Project Presentation

Cross-Platform Pet Care Application

Flutter • Firebase • Riverpod

📊 Key Numbers

- **122** Dart source files
- **~21,200** lines of code
- **43** test files
- **457** automated tests (100% pass rate)
- **15** major features implemented
- **6** domain models
- **10+** use cases
- **2** sprints completed (10 weeks)

📊 Development Metrics

Sprint Completion

- **Sprint 1**: ✅ 100% complete (Weeks 1-5)
- **Sprint 2**: ✅ 100% complete (4 of 6 features, Weeks 6-10)

Feature Breakdown

- **Authentication & User Management**: ✅ Complete
- **Pet Profiles & CRUD**: ✅ Complete
- **Care Plans & Scheduling**: ✅ Complete
- **Local Notifications**: ✅ Complete
- **Sharing & Access Tokens**: ✅ Complete
- **Sitter Dashboard**: ✅ Complete
- **Lost & Found Mode**: ✅ Complete
- **Onboarding Flows**: ✅ Complete

🎯 The Problem

Coordination Challenges in Pet Care

Pet owners struggle with:

- **No single source of truth** for pet information
- **Fragmented communication** between owners, family, and sitters
- **Complex handoffs** when transferring care responsibilities
- **Missed medications or feedings** due to lack of coordination
- **Emergency situations** without quick access to critical pet data

Why It Matters

- **70% of US households** own a pet (2023)
- **Pet care coordination** affects millions daily
- **Medical errors** from miscommunication can be life-threatening
- **Lost pets** need rapid information sharing

💡 The Solution: Petfolio

Core Value Propositions

1. **Real-time Sync**
    - Shared care plans update instantly across all caregivers
    - Task completions visible to owners in real-time
2. **Role-Based Access Control**
    - Owner, co-caretaker, sitter (time-boxed), and public viewer roles
    - Secure, time-limited access tokens

3. **Simple Handoffs**
    - QR code or link generation for instant sharing
    - No complex setup required
4. **Single Source of Truth**
    - Diet, medications, routines, and behavior notes in one place
    - Emergency contacts and medical history always accessible
5. **Lost & Found Support**
    - One-tap "Mark as Lost" functionality
    - Auto-generated missing pet posters

🏗️ Technical Architecture

Technology Stack

- **Frontend**: Flutter 3.x (iOS, Android, Web, Desktop)
- **State Management**: Riverpod
- **Backend**: Firebase (Auth, Firestore, Storage)
- **Notifications**: flutter_local_notifications
- **Architecture**: Clean Architecture with Feature Modules

High-Level Structure

```
lib/
├── app/                 # App shell, routing, theme
├── core/                # Shared widgets
├── features/            # Feature modules
│   ├── auth/
│   ├── pets/
│   ├── care_plans/
│   ├── sharing/
│   ├── lost_found/
│   └── onboarding/
└── services/            # Cross-cutting services
```

🎨 Design Patterns Applied

1. Factory Method Pattern

Factory constructors create objects with different initialization logic:

```
factory CarePlan.fromJson(Map<String, dynamic> json) {
  return CarePlan(
    id: json['id'] as String,
    petId: json['petId'] as String,
    // ... creates CarePlan from JSON
  );
}

factory User.fromFirebaseAuth({required FirebaseUser user}) {
  // ... creates User from Firebase auth
}
```

Usage: Throughout domain models for JSON/Firestore deserialization

Benefits: Encapsulates object creation, supports multiple creation strategies

2. Observer Pattern

Streams and reactive state notify observers of changes:

```
// Firestore streams notify UI of data changes
Stream<List<Pet>> watchPetsForOwner(String ownerId) {
  return _firestore
    .collection('pets')
    .where('ownerId', isEqualTo: ownerId)
    .snapshots()
    .map((snapshot) => snapshot.docs.map(...).toList());
}

// Riverpod providers observe state changes
final authProvider = StreamProvider<User?>((ref) {
  return authService.authStateChanges;
});
```

Usage: Real-time data sync, state management with Riverpod

Benefits: Decoupled components, automatic UI updates

3. Strategy Pattern

Interchangeable algorithms encapsulated in separate classes:

```
abstract class Clock {
  DateTime nowLocal();
  DateTime nowUtc();
}

class SystemClock implements Clock {
  // Uses system time
}

class FixedClock implements Clock {
  // Uses fixed time for testing
}
```

Usage: `Clock` abstraction allows swapping time implementations

Benefits: Testability, flexibility to change time behavior

4. Facade Pattern

Simplified interface to complex subsystems:

```
class AuthService {
  // Simplifies Firebase Auth + Firestore user management
  Future<User?> signUpWithEmailAndPassword(...);
  Stream<User?> get authStateChanges;
}

class QRCodeService {
  // Simplifies QR generation, sharing, URL handling
  Widget generateQRCode({required AccessToken token});
  Future<void> shareQRCode({required AccessToken token});
}
```

Usage: Services like `AuthService`, `QRCodeService`, `CareScheduler`

Benefits: Hides complexity, provides simple API for clients

🔧 SOLID Principles

Single Responsibility Principle (SRP)

- **Repositories**: Only data access
- **Use Cases**: Single business operation
- **Services**: Focused functionality (e.g., `PosterGeneratorService`)

Open/Closed Principle (OCP)

- **Abstract repository interfaces** allow extension without modification
- New implementations can be added without changing existing code

Liskov Substitution Principle (LSP)

- **Repository implementations** are fully substitutable
- Any `CarePlanRepository` implementation works with existing code

🔧 SOLID Principles (Cont.)

Interface Segregation Principle (ISP)

- **Focused interfaces**: `AccessTokenRepository`, `TaskCompletionRepository`
- Clients depend only on methods they use
- No "fat" interfaces

Dependency Inversion Principle (DIP)

- **High-level modules** depend on abstractions (interfaces)
- **Low-level modules** implement those abstractions
- **Riverpod providers** inject dependencies

Example:

```
class SaveCarePlanUseCase {
  final CarePlanRepository _repository;  // Depends on abstraction
  SaveCarePlanUseCase(this._repository);
}
```

🏛️ Clean Architecture Layers

Domain Layer

- **Entities**: `Pet`, `CarePlan`, `AccessToken`, `LostReport`
- **Repository Interfaces**: Abstract contracts
- **Pure business logic**, no dependencies

Data Layer

- **Repository Implementations**: Firestore-specific code
- **DTOs**: Data transfer objects
- **External dependencies** isolated here

Presentation Layer

- **Pages**: UI screens
- **Widgets**: Reusable UI components
- **Providers**: State management

Application Layer

- **Use Cases**: Orchestrate business logic
- **Services**: Cross-cutting concerns

🔐 Security & Access Control

Firestore Security Rules

- **Owner-only access** to pets and care plans
- **Token-based authorization** for sitters
- **Time-boxed access** with automatic expiration
- **Read-only public views** for lost pet posters

Authentication Flow

- Firebase Auth for user identity
- `AuthWrapper` guards protected routes
- Role-based permission checking via `PermissionService`

✅ Quality Assurance

Testing Strategy

- **Unit Tests**: Business logic, use cases, repositories
- **Widget Tests**: UI components
- **Integration Tests**: End-to-end flows

Test Coverage

- **457 tests** across all layers
- **100% pass rate**
- Tests for critical paths: authentication, pet CRUD, care plans, sharing

Code Quality

- **Consistent architecture** across features

📈 Project Achievements

Completed Features

✅ User authentication & onboarding
✅ Pet profile management with photos
✅ Comprehensive care plans (diet, meds, schedules)
✅ Timezone-aware local notifications
✅ QR code & link sharing system
✅ Sitter dashboard with task completion
✅ Real-time task sync
✅ Lost & Found mode with poster generation
✅ Role-based access control
✅ Public profile views

Technical Excellence

- ✅ Clean Architecture implementation
- ✅ SOLID principles throughout
- ✅ Repository & Use Case patterns
- ✅ Comprehensive test suite
- ✅ Production-ready code structure

🚀 Future Enhancements

Planned Features

- **Messaging System**: Owner-sitter chat
- **Push Notifications**: FCM integration
- **Weight Tracking**: Health monitoring with charts
- **Offline Support**: Local caching with Hive
- **Dark Mode**: Complete theme implementation
- **Professional Roles**: Vets, trainers, groomers

Technical Improvements

- Migrate to `go_router` for declarative routing
- Enhanced error reporting with Crashlytics
- Performance optimizations
- Accessibility improvements

📝 Key Takeaways

Problem Solved

Petfolio provides a **unified platform** for pet care coordination, eliminating communication gaps and ensuring consistent care.

Technical Excellence

- **Clean Architecture** with clear separation of concerns
- **SOLID principles** applied consistently
- **Design patterns** (Repository, Use Case, Provider) for maintainability
- **Comprehensive testing** for reliability

Impact

- **Real-world applicability**: Solves actual coordination problems
- **Scalable foundation**: Architecture supports future growth
- **Production-ready**: Code quality suitable for deployment

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