CAPSTONE BANKING SYSTEM DOCUMENTATION

GROUP 6

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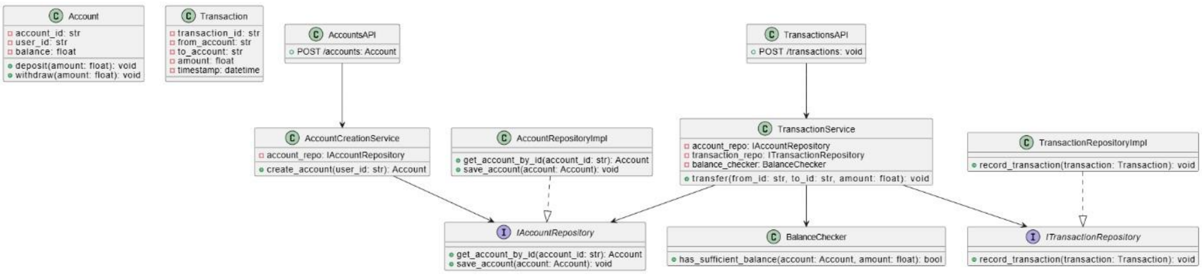
UML DIAGRAM

Figure 1: This figure shows the UML class diagram for our capstone-banking system



HOW IT WORKS AND INTERGRATES.

1. Domain Layer

The **Domain Layer** is the heart of the application, containing the core business logic and rules. It defines the fundamental entities (Account, Transaction) and their behaviors, independent of external frameworks or infrastructure.

- **Entities**:
  - Account (and its subclasses **SavingsAccount**, **CheckingAccount**) encapsulates account properties (ID, type, balance) and enforces business rules (e.g., minimum balance for savings accounts, overdraft limits for checking accounts).
  - Transaction models financial actions (deposit, withdrawal) with attributes like amount, type, and timestamp.

- **Purpose**:
  This layer ensures business rules (e.g., "a savings account cannot go below $100") are centralized and reusable. It has no dependencies on external systems, making it immune to changes in databases or APIs.

2. Application Layer

The **Application Layer** orchestrates business workflows by coordinating domain objects and infrastructure components. It translates user actions (e.g., creating an account) into domain operations.

- **Services**:
  - **AccountCreationService** handles account creation, validating initial deposits and instantiating the correct Account subclass based on type (checking/savings). o **TransactionService** manages deposits/withdrawals, updating account balances and generating transaction records.
- **Dependencies**:
  - Relies on **Domain Layer** entities (e.g., **Account.withdraw()**) to enforce rules.
  - Depends on **Infrastructure Layer** interfaces (e.g., **AccountRepository**) to persist data, adhering to the *Dependency Inversion Principle*.
- **Purpose**:
  This layer acts as a mediator, ensuring use cases (e.g., "transfer funds") are executed consistently while keeping domain logic decoupled from technical details.

3. Infrastructure Layer

The **Infrastructure Layer** provides implementations for external interactions, such as data storage or third-party services. It adapts the core system to real-world tools.

- **Components**:
  - InMemoryAccountRepository and InMemoryTransactionRepository implement repository interfaces, using Python dictionaries to simulate databases. o **Adapters**: In a real-world scenario, these could be replaced with SQL/NoSQL databases or external APIs without altering the Domain/Application layers.
- **Integration**:
  - Implements interfaces defined in the **Application Layer** (e.g., **AccountRepository**), allowing the Application Layer to remain agnostic to storage details.

    - For example, when **TransactionService** saves a transaction, it calls **transaction_repo.save_transaction(),** which delegates to the in-memory repository.

- **Purpose**:
  This layer handles I/O operations, ensuring the core logic remains pure and testable.

4. Presentation Layer

The **Presentation Layer** exposes the system's functionality to external users or systems, typically via RESTful APIs.

- **Components**:
    - FastAPI routes (e.g., POST /accounts, POST /deposit) define endpoints that map HTTP requests to application services.
    - Uses **Pydantic** models (e.g., **CreateAccountRequest**) to validate input and serialize responses.
- **Integration**:
    - Routes inject dependencies (e.g., **AccountCreationService**) from the **Application Layer**, which in turn rely on **Infrastructure Layer** repositories.
    - For example, a POST /accounts request triggers **AccountCreationService.create_account(),** which uses the repository to persist the new account.
- **Purpose**:
  This layer acts as the system's "front door," translating HTTP requests into domain actions and returning structured responses (e.g., JSON).

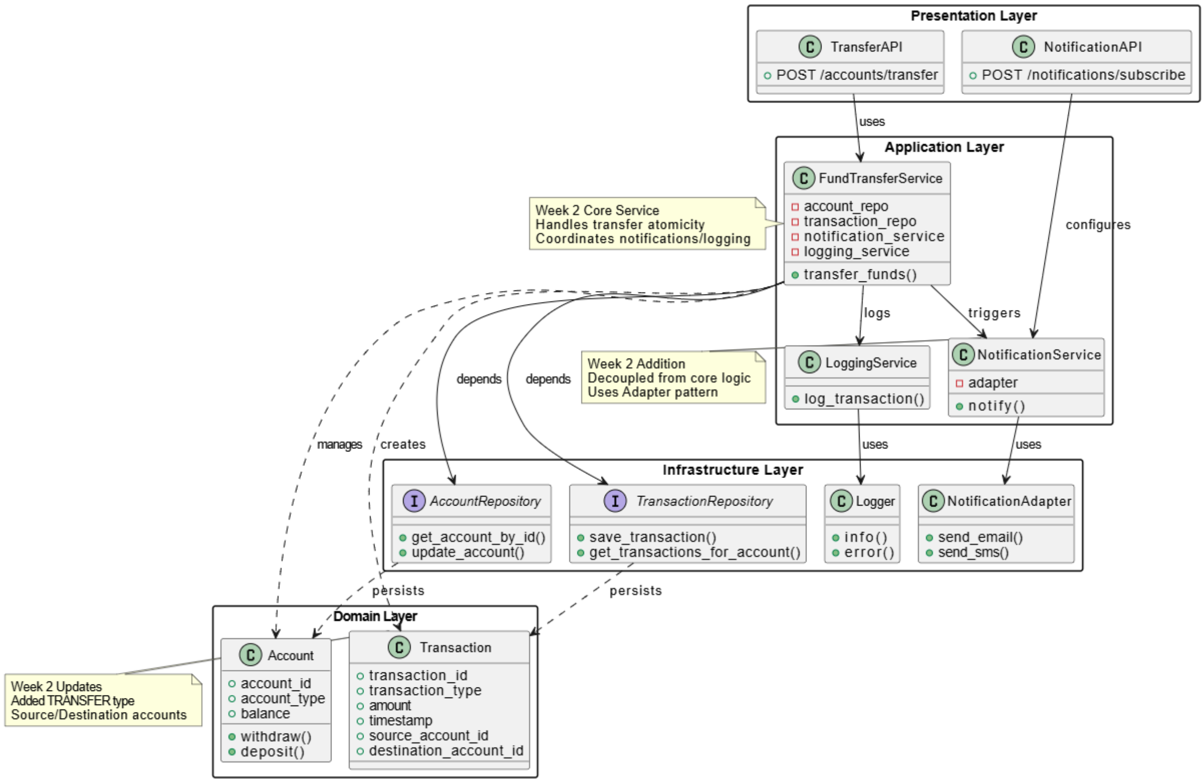
Layer Integration Flow

1. **Request Handling**:
    - A user sends an HTTP request (e.g., POST /accounts with account details).
    - The **Presentation Layer** (FastAPI) validates the request and forwards it to the **Application Layer** (**AccountCreationService**).
2. **Business Logic Execution**:
    - The **Application Layer** uses **Domain Layer** entities (e.g., **SavingsAccount**) to enforce rules (e.g., minimum deposit).

- It delegates data persistence to the **Infrastructure Layer** (e.g., **InMemoryAccountRepository.create_account**()).

3. **Response Generation**:
   - Results are serialized by the **Presentation Layer** into JSON and returned to the user.

Week 2 ;
Diagram showing newly introduced classes and their interactions.



The **transfer, notification, and logging workflows** are integrated into the banking application using **Clean Architecture** and **SOLID principles**, ensuring separation of concerns and maintainability. Below is a breakdown of their integration:

1. Transfer Workflow

Objective: Enable atomic fund transfers between accounts while maintaining data consistency.

Integration:

- **API Endpoint**:
  - Exposes POST /accounts/transfer to trigger transfers.
  - Accepts sourceAccountId, destinationAccountId, and amount.

2.Notification Workflow

Objective: Automatically notify users after transactions without coupling to core logic.

Integration:

- **NotificationService** (Application Layer):
  - Invoked after successful transactions (deposit/withdraw/transfer).
  - Accepts a Transaction object and generates user-friendly messages.
- **Infrastructure**:
  - **NotificationAdapter**: Abstract interface for sending notifications.
    - Implementations: EmailAdapter, SMSAdapter, or MockAdapter (for testing).
  - Decoupled from transaction logic via dependency injection.

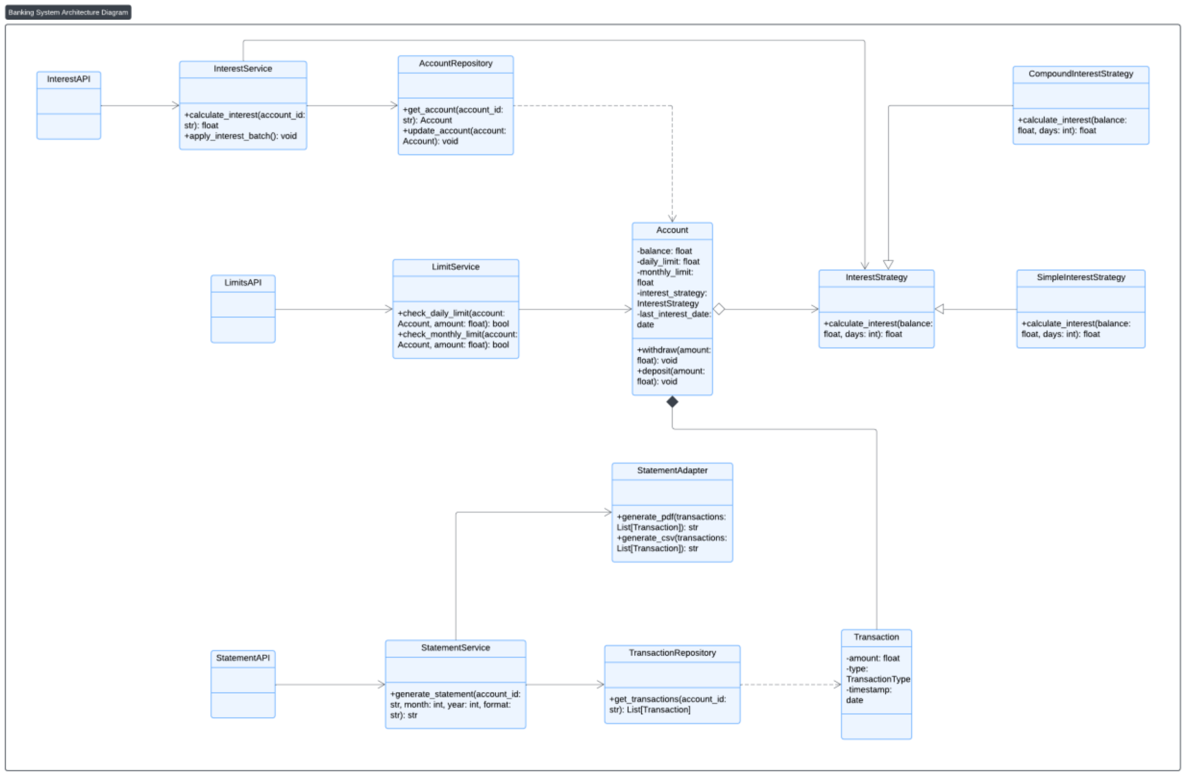
3. Logging Workflow

Objective: Audit transactions without cluttering business logic.

Integration:

- **LoggingService** (Application Layer):
  - Wraps critical operations (e.g., transfers) to log details.
  - Logs include transaction ID, amount, timestamp, and involved accounts.
- **Infrastructure**:
  - **Logger Adapter**: Abstracts logging mechanisms (e.g., file, database, cloud services).
  - Uses Python's built-in logging module or third-party tools

Week3;
UML diagram showing how interest logic, limit systems, and statement generation integrate with existing modules.



Statement-Building Pipeline

The statement-generation process follows a **modular, stepwise approach** to transform raw transaction data into formatted reports (PDF/CSV). Here's the workflow:

1. **Data Collection**
    - **Input**: Account ID, Month/Year, Format (PDF/CSV)
    - **Step**:
        - StatementService requests transactions from the TransactionRepository.
        - Filters transactions by date using domain logic.
2. **Data Processing**
    - **Components**:
        - **Interest Calculation**: Pulls accrued interest from InterestService.
        - **Limit Tracking**: Includes daily/monthly limit usage from Account entity.
    - **Output**: Structured data with transactions, interest, and balances.
3. **Formatting**
    - **Adapter Pattern**: Delegates to StatementAdapter implementations:
        - **PDF Generation**: Uses libraries like ReportLab.
        - **CSV Generation**: Uses Python's built-in csv module.
    - **Output**: Final file in requested format.
4. **Delivery**
    - Returns file as download/email attachment via the Presentation Layer.

Pipeline Flow:
API Request → StatementService → TransactionRepository →
Filter by Date → Add Interest Data → Format via Adapter → Return File