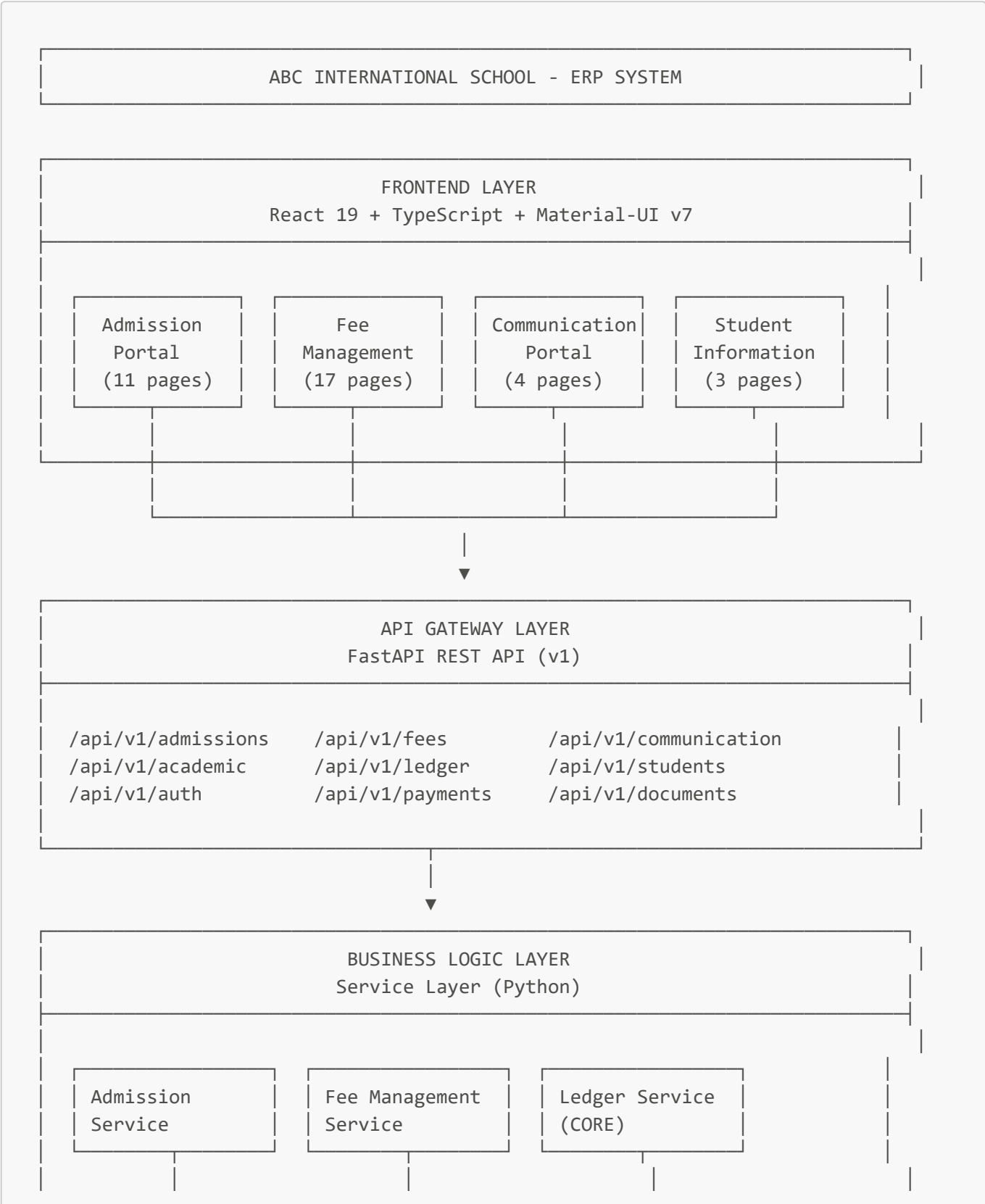
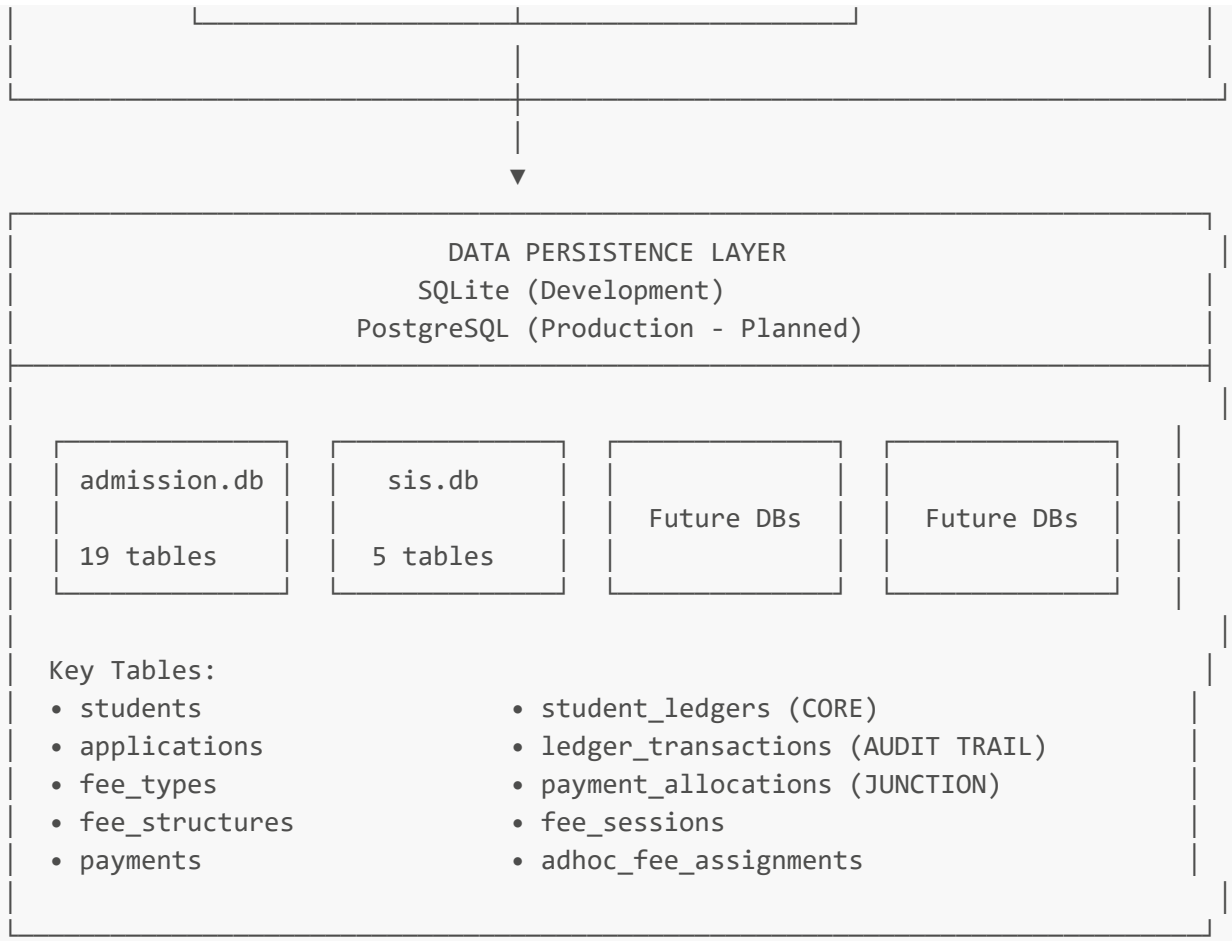
Ledger-Centric Architecture - Visual Diagrams

This document contains various diagrams explaining the ledger-centric architecture and surrounding features implemented in the ABC International School system.

1. System Architecture Overview (High-Level)





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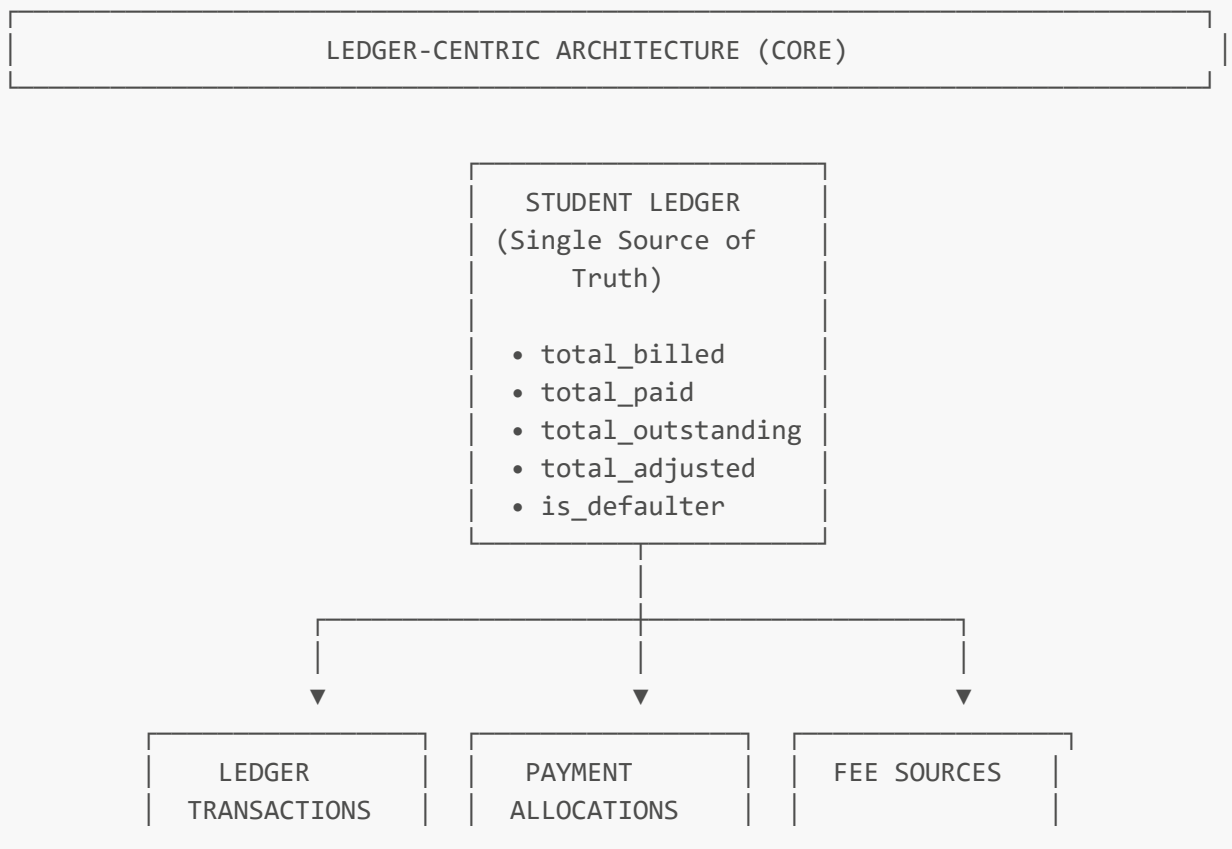
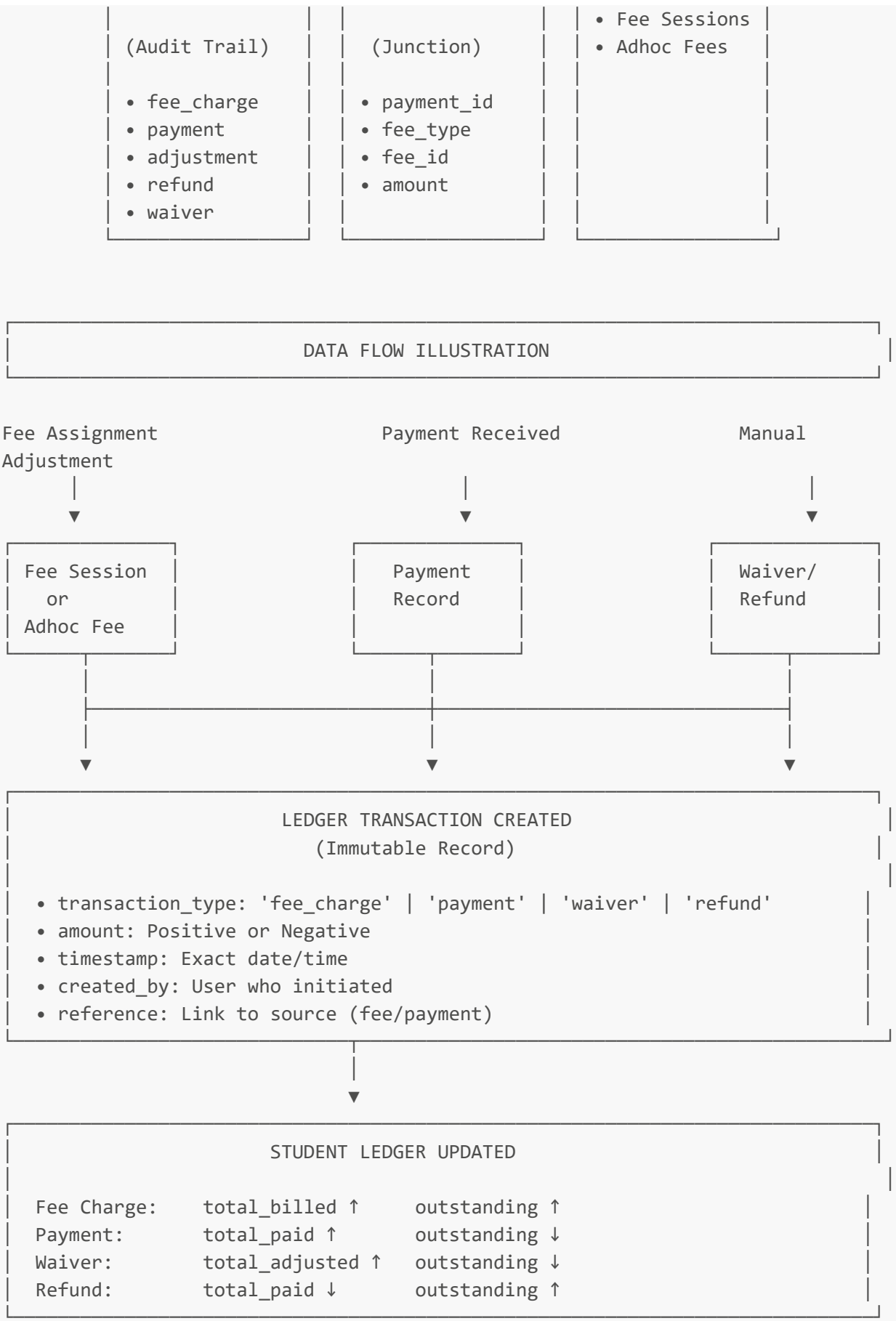
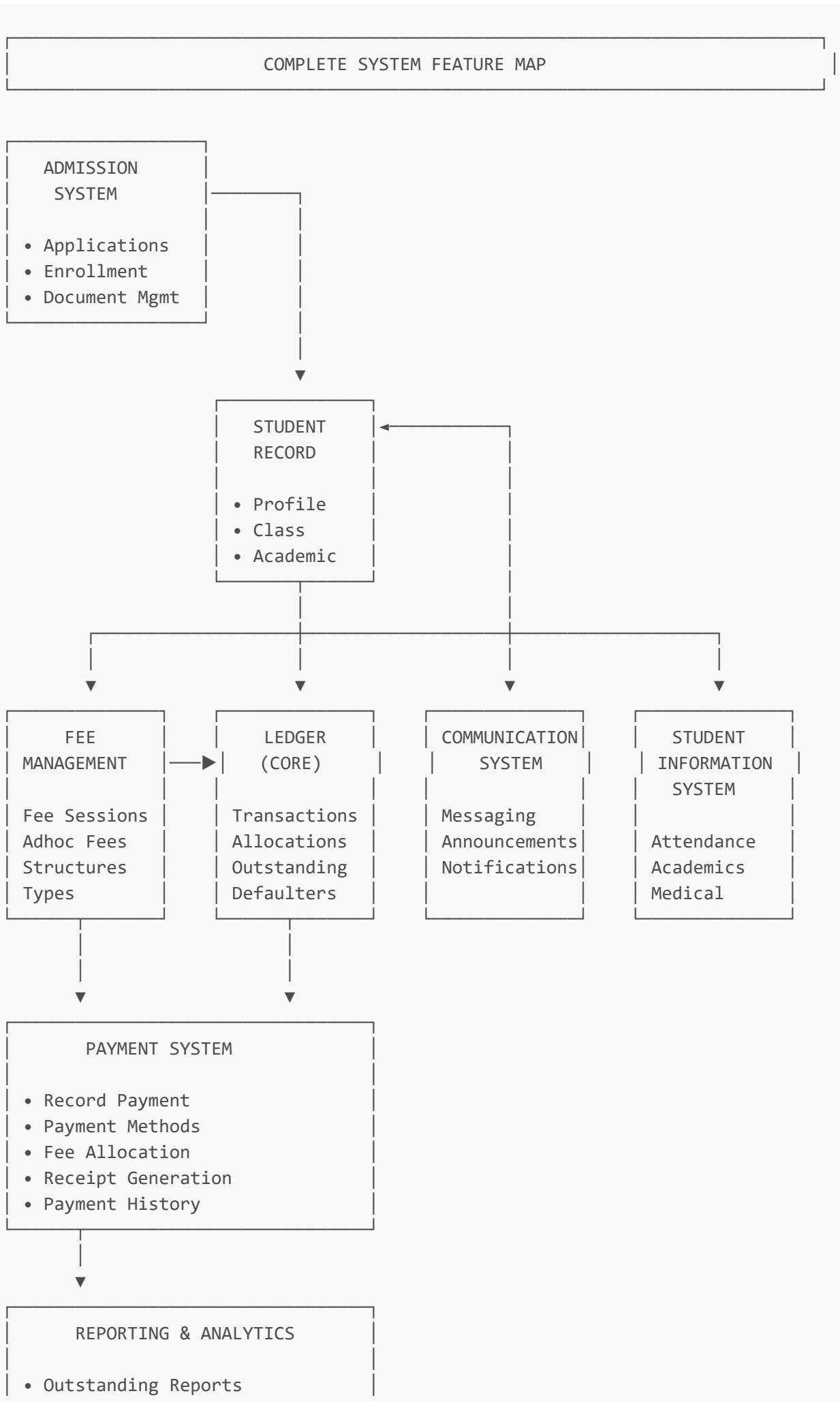
2. Ledger-Centric Architecture - Core Component Diagram





3. Feature Integration Map - How Everything Connects


COMPLETE SYSTEM FEATURE MAP
ADMISSION SYSTEM
• Applications
• Enrollment
• Document Mgmt
STUDENT RECORD
• Profile
• Class
• Academic
FEE MANAGEMENT
Fee Sessions
Adhoc Fees
Structures
Types
LEDGER (CORE)
Transactions
Allocations
Outstanding
Defaulters
COMMUNICATION SYSTEM
Messaging
Announcements
Notifications
STUDENT INFORMATION SYSTEM
Attendance
Academics
Medical
PAYMENT SYSTEM
• Record Payment
• Payment Methods
• Fee Allocation
• Receipt Generation
• Payment History
REPORTING & ANALYTICS
• Outstanding Reports

```
│ • Collection Trends                │
│ • Defaulter Lists                  │
│ • Revenue Analysis                 │
│ • Payment Allocation Reports       │
└────────────────────────────────────┘


┌──────────────────────────────────────────────────────────────────────────────┐
│                        CROSS-CUTTING CONCERNS                                │
├──────────────────────────────────────────────────────────────────────────────┤
│                                                                              │
│  Authentication & Authorization (JWT)                                        │
│  ├─ Admin Portal (Full Access)                                               │
│  ├─ Parent Portal (Limited Access)                                           │
│  └─ Student Portal (Read-only - Planned)                                     │
│                                                                              │
│  Audit Trail & History                                                       │
│  ├─ Application Status History                                               │
│  ├─ Ledger Transaction History                                               │
│  ├─ Payment History                                                          │
│  └─ Message Delivery Tracking                                                │
│                                                                              │
│  Document Management                                                         │
│  ├─ Application Documents (Birth Cert, Photos)                               │
│  ├─ Student Documents (TC, Medical)                                          │
│  └─ Fee Receipts                                                             │
│                                                                              │
│  Notification System (Planned)                                               │
│  ├─ SMS Notifications (MSG91)                                                │
│  ├─ Email Notifications (SendGrid)                                           │
│  └─ In-app Notifications                                                     │
│                                                                              │
└──────────────────────────────────────────────────────────────────────────────┘
```

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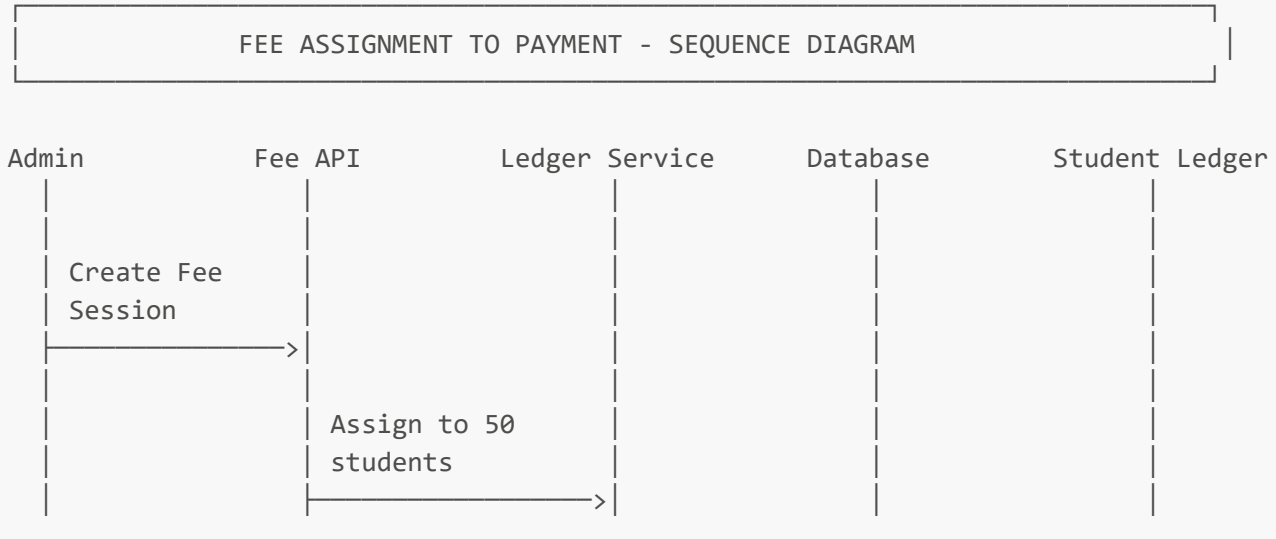
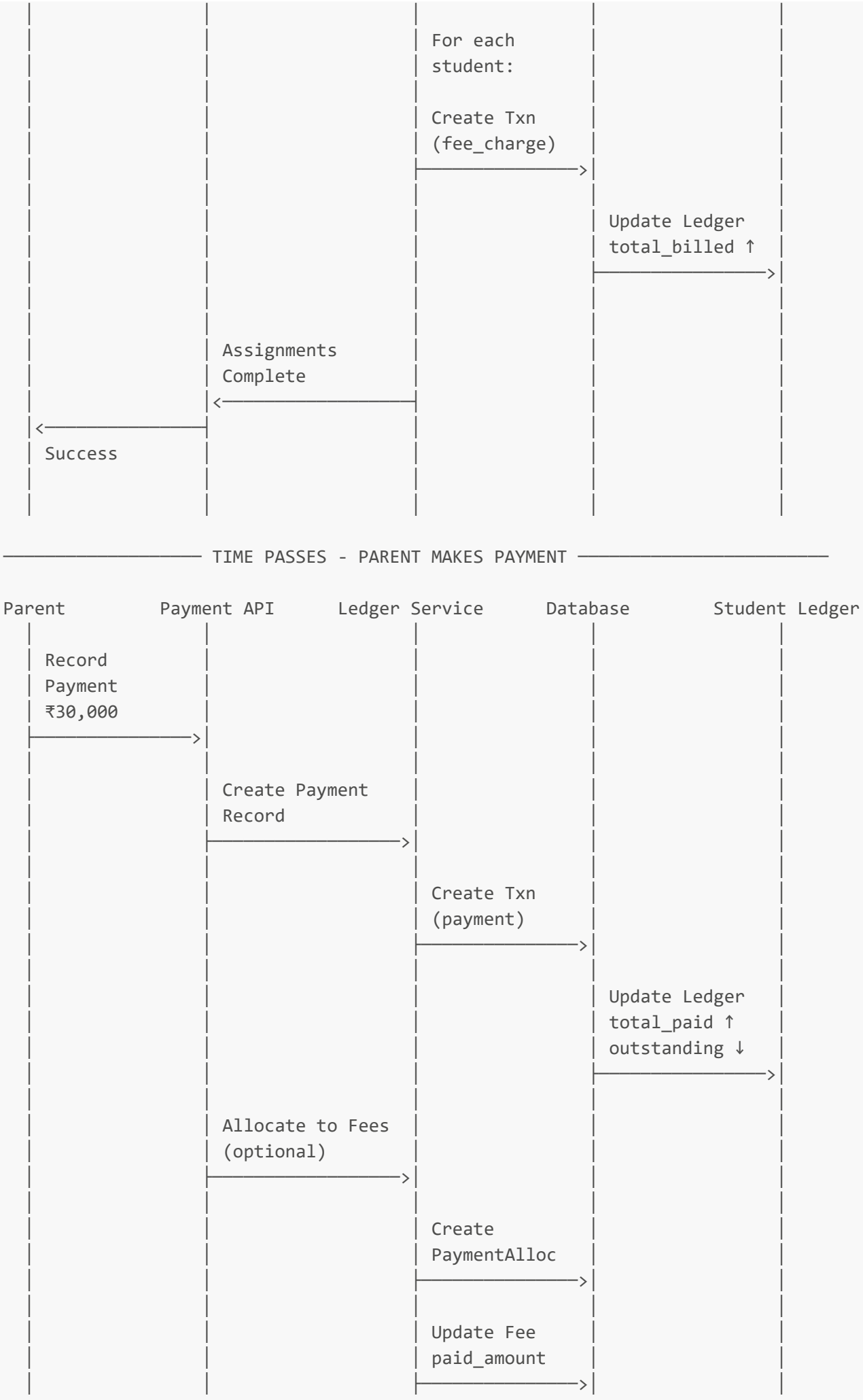
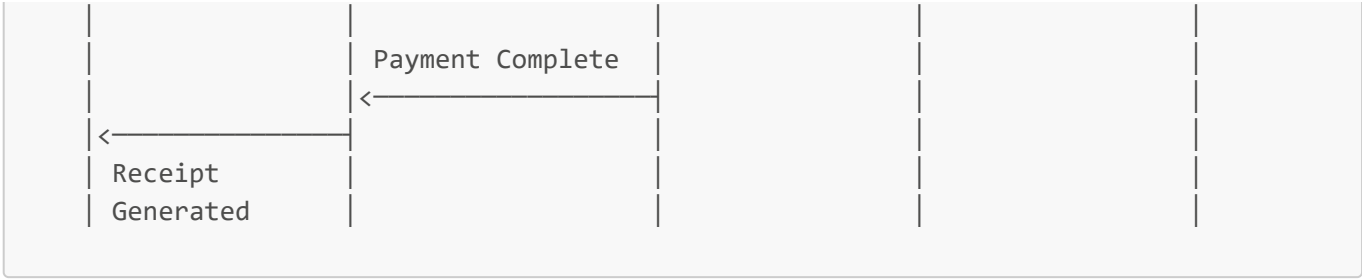
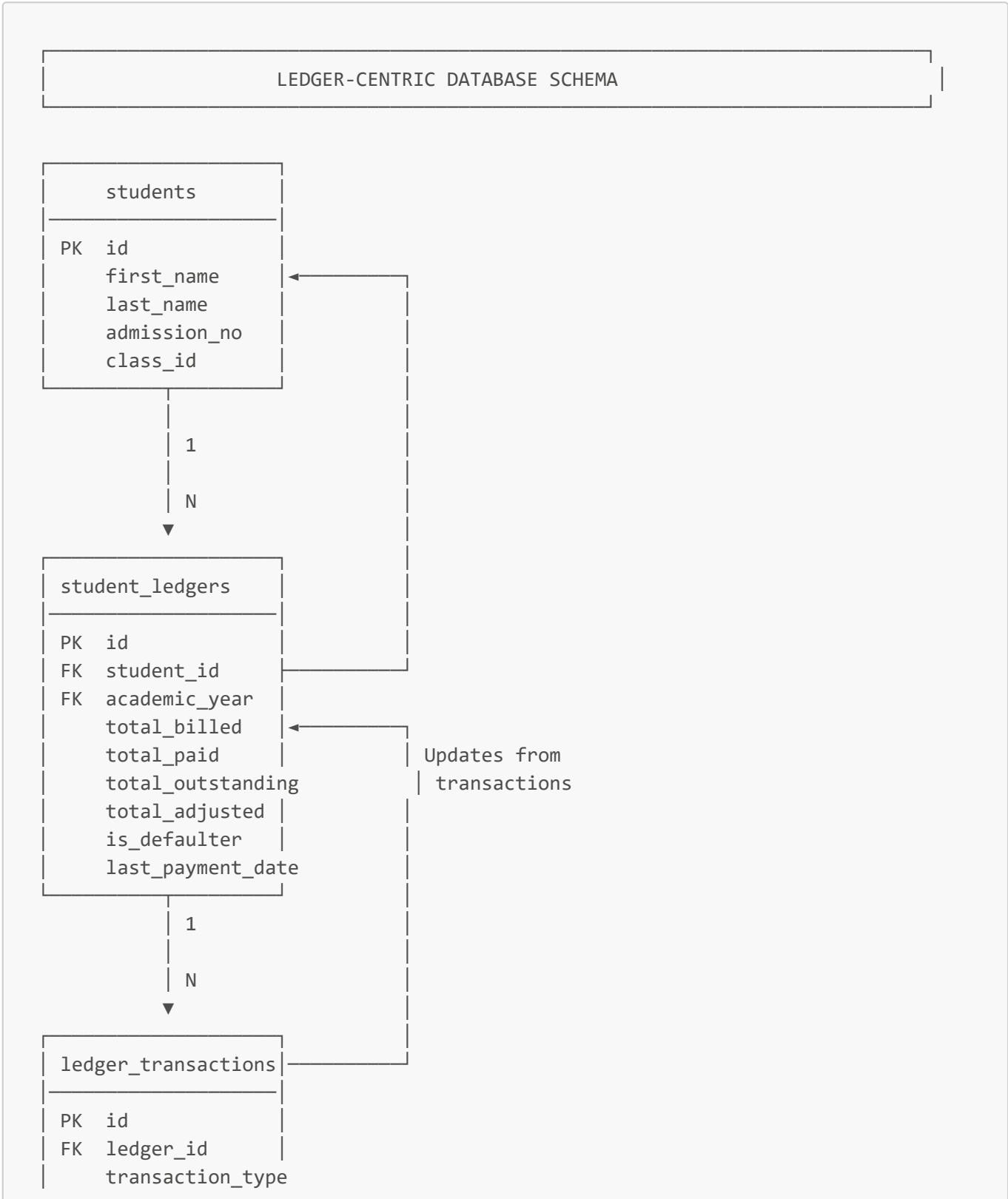
4. Ledger Transaction Flow - Detailed Sequence Diagram

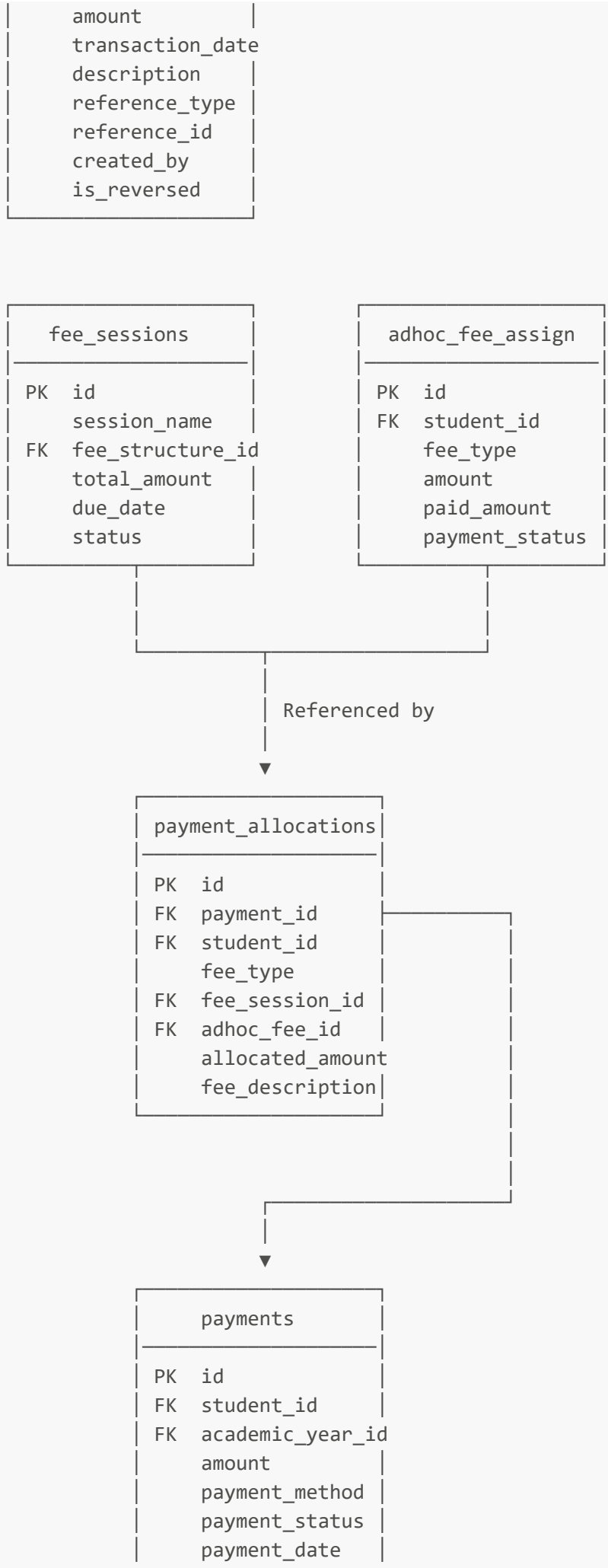



For each student:
Create Txn (fee_charge)
Update Ledger total_billed ↑
Assignments Complete
Success
TIME PASSES - PARENT MAKES PAYMENT
Parent
Payment API
Ledger Service
Database
Student Ledger
Record Payment ₹30,000
Create Payment Record
Create Txn (payment)
Update Ledger total_paid ↑ outstanding ↓
Allocate to Fees (optional)
Create PaymentAlloc
Update Fee paid_amount



5. Database Entity-Relationship Diagram (ERD)




amount
transaction_date
description
reference_type
reference_id
created_by
is_reversed
fee_sessions
PK id
session_name
FK fee_structure_id
total_amount
due_date
status
adhoc_fee_assign
PK id
FK student_id
fee_type
amount
paid_amount
payment_status
Referenced by
payment_allocations
PK id
FK payment_id
FK student_id
fee_type
FK fee_session_id
FK adhoc_fee_id
allocated_amount
fee_description
payments
PK id
FK student_id
FK academic_year_id
amount
payment_method
payment_status
payment_date

```
            │     transaction_id │
            │     receipt_number │
            └────────────────────┘


┌──────────────────────┐
│   fee_types          │
├──────────────────────┤
│ PK  id               │
│     type_name        │
│     code             │
│     frequency        │
│     is_mandatory     │
│     is_taxable       │
│     tax_rate         │
└──────────┬───────────┘
           │ 1
           │
           │ N
           ▼
┌──────────────────────┐
│ fee_structures       │
├──────────────────────┤
│ PK  id               │
│ FK  fee_type_id      │
│ FK  class_id         │
│ FK  academic_year_id │
│     amount           │
│     is_active        │
└──────────────────────┘
```

---

6. User Journey Flow Diagram

```
┌──────────────────────────────────────────────────────────────────────────────┐
│                        COMPLETE USER JOURNEY MAP                             │
└──────────────────────────────────────────────────────────────────────────────┘

JOURNEY 1: ADMISSION TO ENROLLMENT
═══════════════════════════════════════════════════════════════════════════════

Parent                                    Admin
  │                                         │
  ├─ Register Account                       │
  │  (Email/Password)                       │
  │                                         │
  ├─ Fill Application Form                  │
  │  (5-step wizard)                        │
  │  • Student Info                         │
  │  • Parent Info                          │
  │  • Address                              │
```

```
    │  • Academic Background              │
    │  • Review & Submit                  │
    │                                     │
    ├─ Upload Documents                   │
    │  (Birth Cert, Photos, etc.)         │
    │                                     │
    ├─ Submit Application ──────────────> Review Application
    │                                     │
    │                                     ├─ View Details
    │                                     ├─ Check Documents
    │                                     ├─ Schedule Test/Interview
    │                                     │
    ├◄──── Test Scheduled ────────────────┤
    │                                     │
    ├─ Attend Test                        │
    │                                     │
    │                                     ├─ Record Test Scores
    │                                     │
    ├◄──── Interview Scheduled ───────────┤
    │                                     │
    ├─ Attend Interview                   │
    │                                     │
    │                                     ├─ Make Decision
    │                                     │  (Approve/Reject)
    │                                     │
    ├◄──── Admission Approved ────────────┤
    │      (or Rejected)                  │
    │                                     │
    │                                     ├─ Mark as Enrolled
    │                                     │
    ├◄──── Welcome Email ─────────────────┤
    │      Student ID Generated           │
    │                                     │
    └─ Student Record Created             └─ Assign to Class


JOURNEY 2: FEE COLLECTION & PAYMENT
═══════════════════════════════════════════════════════════════════════

Admin                                   Parent/Student
  │                                       │
  ├─ Configure Fee Types                  │
  │  (Tuition, Transport, Exam, etc.)     │
  │                                       │
  ├─ Create Fee Structures                │
  │  (Amount per class/year)              │
  │                                       │
  ├─ Create Fee Session                   │
  │  (Assign fees to students)            │
  │                                       │
  │  ┌──────────────────────────────────┐  │
  │  │   LEDGER SYSTEM ACTIVATED        │  │
  │  │                                  │  │
  │  │ • Ledger Transaction Created     │  │
```

```
    │   │   (type: fee_charge)            ||
    │   │                                  ||
    │   │ • Student Ledger Updated         ||
    │   │   total_billed ↑                 ||
    │   │   outstanding ↑                  ||
    │   └──────────────────────────────────┘|
    │                                       |
    ├─ Fee Notification Sent ──────────────>|
    │                                       |
    │                                       ├─ View Outstanding Fees
    │                                       │  (Parent Dashboard)
    │                                       |
    │                                       ├─ Make Payment
    │                                       │  (Online/Offline)
    │                                       |
    │<─── Payment Received ─────────────────┤
    │                                       |
    │   ┌──────────────────────────────────┐|
    │   │   LEDGER SYSTEM ACTIVATED        ||
    │   │                                  ||
    │   │ • Payment Record Created         ||
    │   │                                  ||
    │   │ • Ledger Transaction Created     ||
    │   │   (type: payment)                ||
    │   │                                  ||
    │   │ • Payment Allocation Created     ||
    │   │   (links payment to fees)        ||
    │   │                                  ||
    │   │ • Student Ledger Updated         ||
    │   │   total_paid ↑                   ||
    │   │   outstanding ↓                  ||
    │   │                                  ||
    │   │ • Fee Session Updated            ||
    │   │   paid_amount ↑                  ||
    │   └──────────────────────────────────┘|
    │                                       |
    ├─ Generate Receipt ──────────────────>|
    │                                       |
    │                                       ├─ Download Receipt
    │                                       |
    ├─ View Collection Reports              |
    │  • Outstanding Fees                   |
    │  • Defaulter List                     |
    │  • Collection Trends                  |
    │                                       |


JOURNEY 3: PARENT-TEACHER COMMUNICATION
═══════════════════════════════════════════════════════════════════════════

Teacher/Admin                          Parent
    │                                    |
    ├─ Create Message                    |
    │  • Select Class/Students           |
```

```
    │  • Compose Message                  │
    │  • Schedule (optional)              │
    │                                     │
    ├─ Send Message ──────────────────────>│
    │                                     │
    │  ┌──────────────────────────────────┐│
    │  │ Message Delivery Tracked:        ││
    │  │ • sent_at timestamp              ││
    │  │ • delivered_at (when opened)     ││
    │  │ • read_at (when read)            ││
    │  └──────────────────────────────────┘│
    │                                     │
    │                                     ├─ Notification Received
    │                                     │  (Badge count updated)
    │                                     │
    │                                     ├─ Open Message
    │                                     │  (delivered_at recorded)
    │                                     │
    │                                     ├─ Read Message
    │                                     │  (read_at recorded)
    │                                     │
    ├<──── Read Receipt ──────────────────┤
    │                                     │
    ├─ View Message Statistics            │
    │  • Total Recipients: 45             │
    │  • Delivered: 42                    │
    │  • Read: 38                         │
    │  • Read Rate: 84%                   │
    │                                     │
    ├─ Make Announcement                  │
    │  (All parents)                      │
    │                                     │
    ├─ Broadcast ─────────────────────────>│
    │                                     │
    │                                     ├─ View Announcements
    │                                     │
```

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7. Technology Stack Diagram

```
┌──────────────────────────────────────────────────────────────────────────┐
│                        TECHNOLOGY STACK                                  │
└──────────────────────────────────────────────────────────────────────────┘


┌──────────────────────────────────────────────────────────────────────────┐
│                              FRONTEND                                    │
├──────────────────────────────────────────────────────────────────────────┤
│                                                                          │
│  React 19 (Latest)          TypeScript 5.x          Vite 7.1.9           │
│  Material-UI v7             React Router v6         Axios                │
│  React Hook Form            Date-fns                MUI X Date Pickers   │
```

```
│                                                                              │
│  Pages: 43                    Routes: 45+              Components: 100+      │
│                                                                              │
└──────────────────────────────────────────────────────────────────────────────┘

┌──────────────────────────────────────────────────────────────────────────────┐
│                              BACKEND                                         │
├──────────────────────────────────────────────────────────────────────────────┤
│                                                                              │
│  FastAPI 0.104+               Python 3.10+             SQLAlchemy 2.0        │
│  Pydantic v2                  JWT (python-jose)        Bcrypt 4.0.1          │
│  Uvicorn                      Alembic (migrations)     Python-multipart      │
│                                                                              │
│  APIs: 80+ endpoints          Services: 8              Models: 25+           │
│                                                                              │
└──────────────────────────────────────────────────────────────────────────────┘

┌──────────────────────────────────────────────────────────────────────────────┐
│                             DATABASE                                         │
├──────────────────────────────────────────────────────────────────────────────┤
│                                                                              │
│  Development:  SQLite (2 databases - admission.db, sis.db)                   │
│  Production:   PostgreSQL (Planned)                                          │
│                                                                              │
│  Tables: 24                   Indexes: 50+             Relationships: 30+    │
│                                                                              │
└──────────────────────────────────────────────────────────────────────────────┘

┌──────────────────────────────────────────────────────────────────────────────┐
│                          PLANNED INTEGRATIONS                                │
├──────────────────────────────────────────────────────────────────────────────┤
│                                                                              │
│  Payment Gateway:    Razorpay / PayU / CCAvenue                              │
│  SMS Service:        MSG91 / Twilio                                          │
│  Email Service:      SendGrid / AWS SES                                      │
│  Translation:        MS Translator API                                       │
│  Storage:            AWS S3 / Azure Blob (Document storage)                  │
│  Deployment:         Docker + Kubernetes / AWS ECS                           │
│                                                                              │
└──────────────────────────────────────────────────────────────────────────────┘
```

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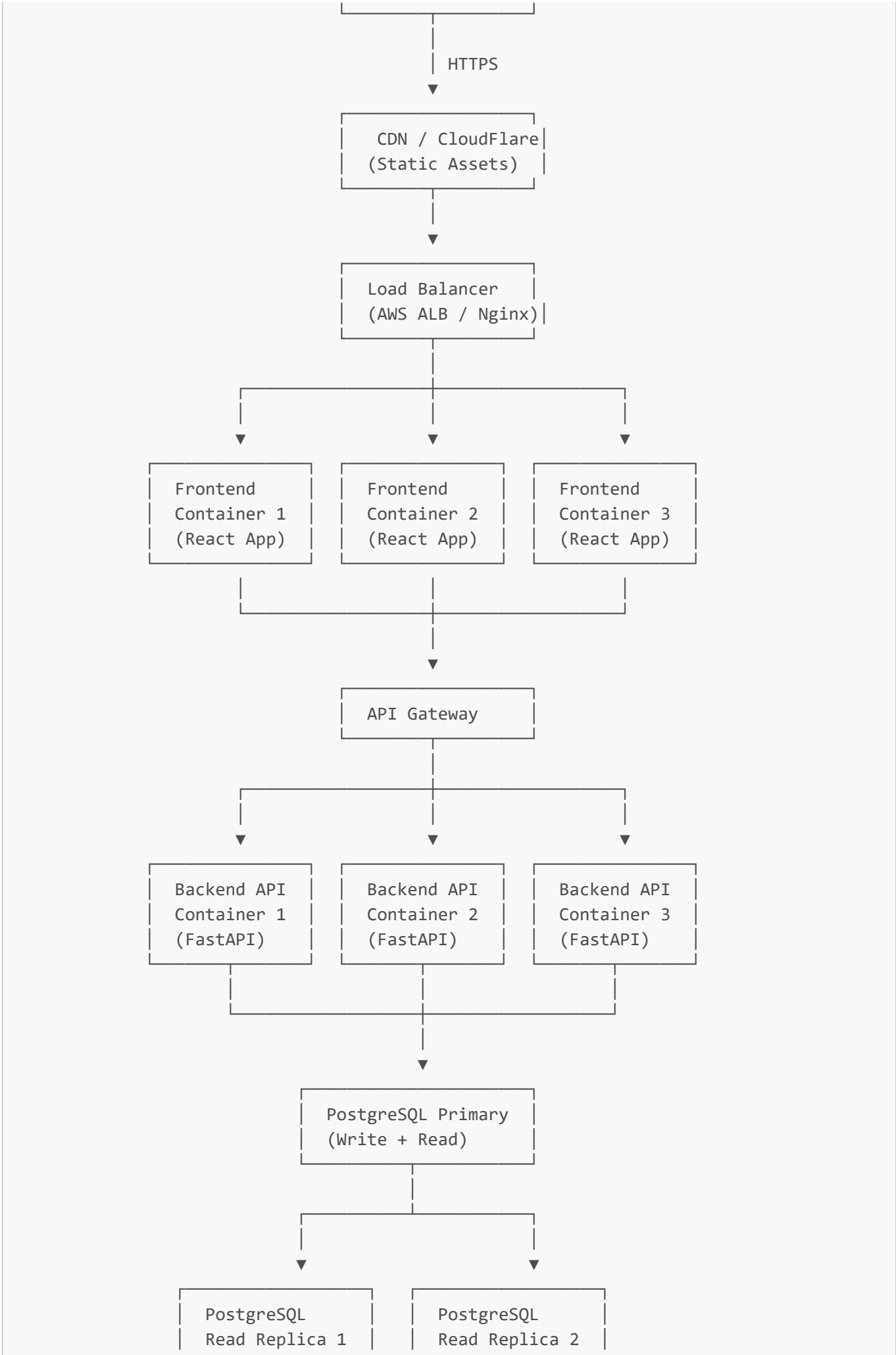
8. Deployment Architecture (Future)

```
┌──────────────────────────────────────────────────────────────────────────────┐
│                    PRODUCTION DEPLOYMENT ARCHITECTURE                        │
└──────────────────────────────────────────────────────────────────────────────┘

                          ┌──────────────────┐
                          │   Users/Parents  │
                          │     Browsers     │
```


HTTPS
CDN / CloudFlare
(Static Assets)
Load Balancer
(AWS ALB / Nginx)
Frontend
Container 1
(React App)
Frontend
Container 2
(React App)
Frontend
Container 3
(React App)
API Gateway
Backend API
Container 1
(FastAPI)
Backend API
Container 2
(FastAPI)
Backend API
Container 3
(FastAPI)
PostgreSQL Primary
(Write + Read)
PostgreSQL
Read Replica 1
PostgreSQL
Read Replica 2

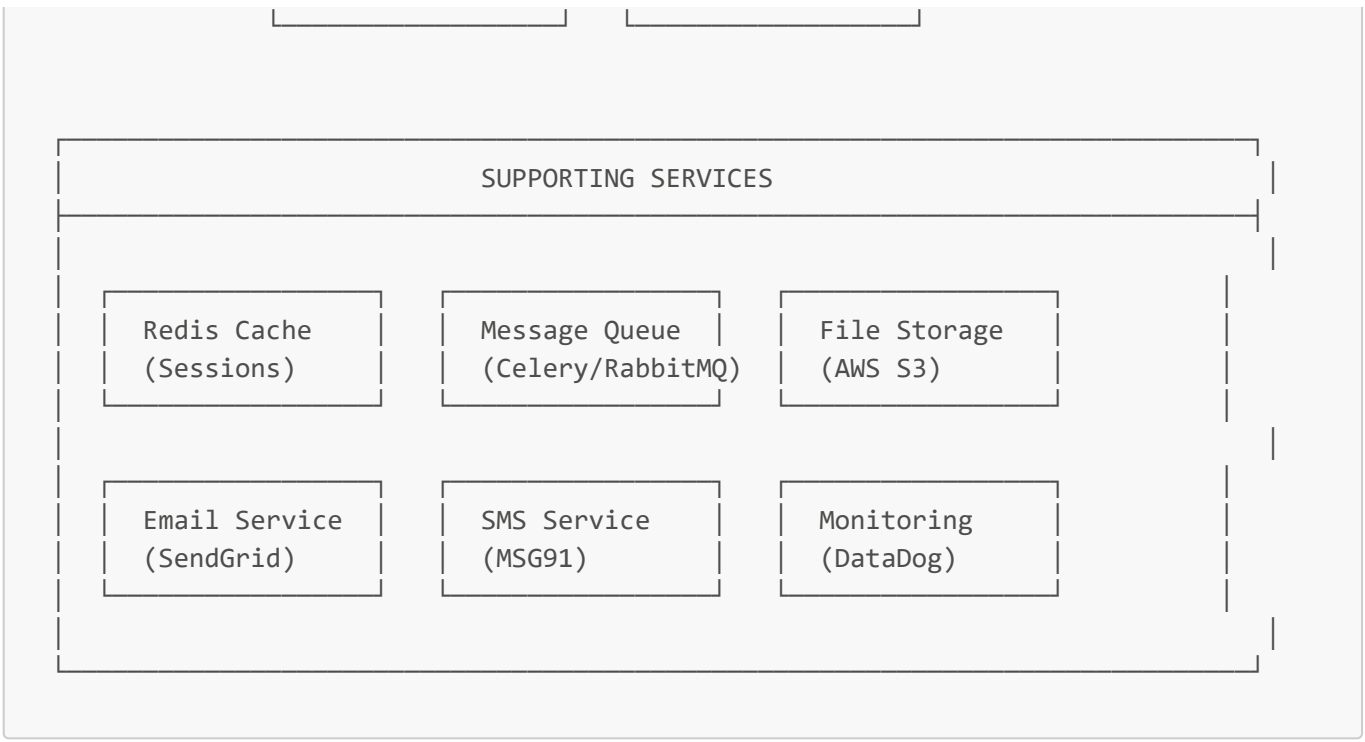


Diagram Usage Guide

Which Diagram to Use When:

1. **System Architecture Overview** - For high-level presentations to stakeholders
2. **Ledger-Centric Core** - For technical team understanding the financial system
3. **Feature Integration Map** - For product roadmap discussions
4. **Transaction Flow** - For debugging payment issues or understanding flow
5. **Database ERD** - For database design reviews and optimization
6. **User Journey Flow** - For UX discussions and training materials
7. **Technology Stack** - For technical hiring and onboarding
8. **Deployment Architecture** - For DevOps planning and scaling discussions

Creating Visual Diagrams:

These ASCII diagrams can be converted to visual diagrams using:

- **Mermaid.js** - For sequence diagrams and flowcharts
- **PlantUML** - For UML diagrams and ERDs
- **Draw.io / Lucidchart** - For polished presentation diagrams
- **Figma / Excalidraw** - For collaborative design

Last Updated: October 23, 2025 Document Version: 1.0 Contact: Technical Architecture Team