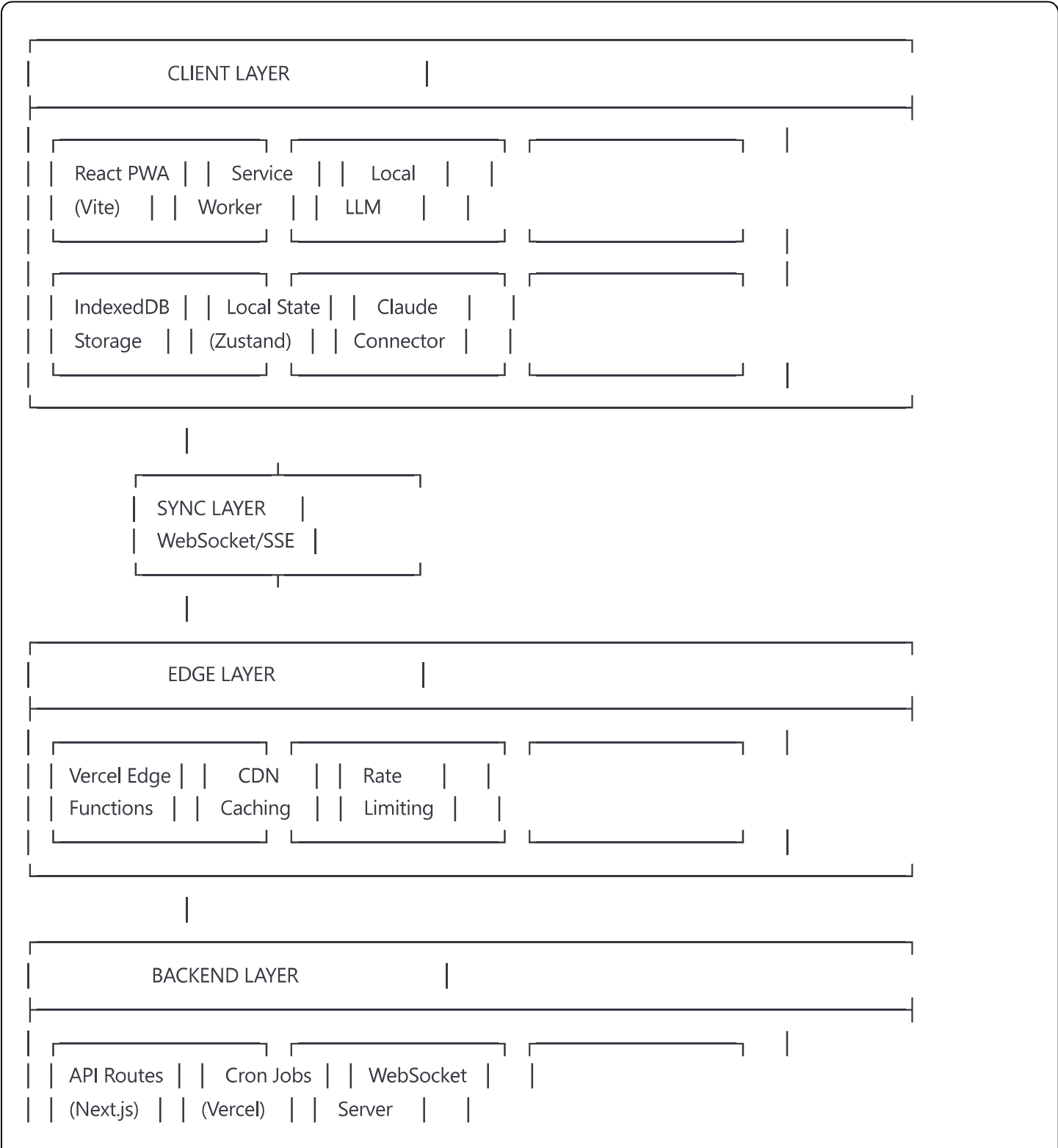


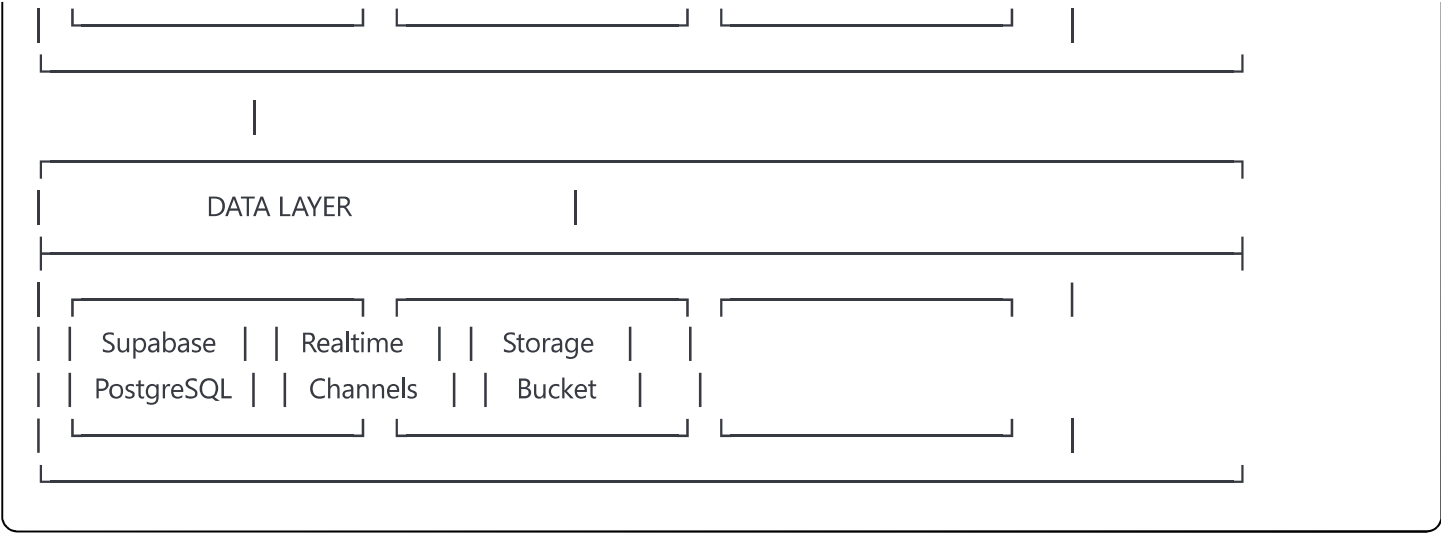
System Architecture Document

AI-Powered Personal Productivity System

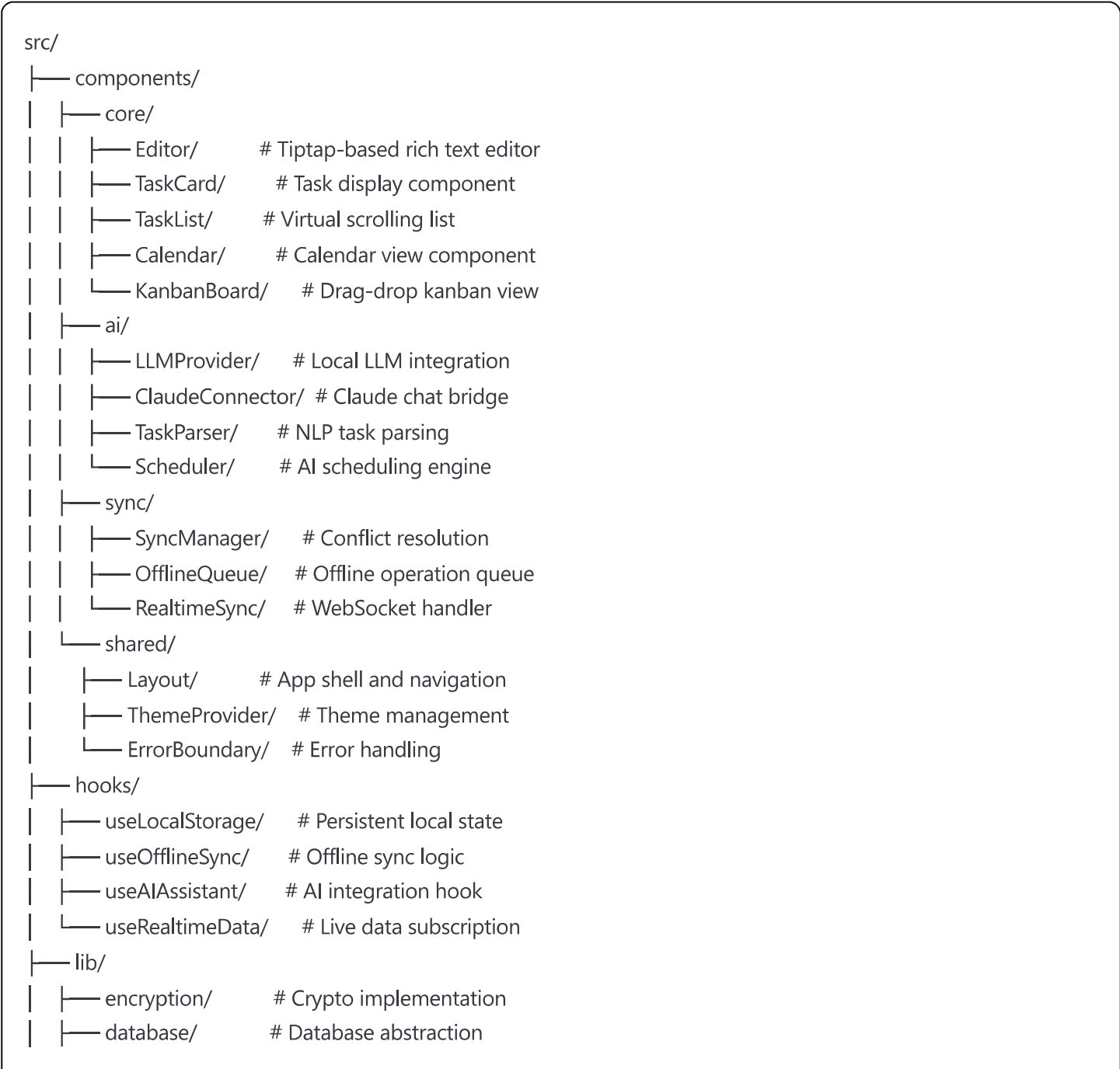
2.1 Architecture Overview

High-Level Architecture





Component Architecture



```
| |— ai/          # AI/LLM utilities
| |— sync/       # Sync algorithms
|— api/
| |— tasks/      # Task CRUD operations
| |— sync/       # Sync endpoints
| |— auth/       # Authentication
| |— cron/       # Scheduled jobs
|— workers/
|— service-worker.js # PWA service worker
|— sync-worker.js   # Background sync
|— ai-worker.js     # AI processing worker
```

2.2 Data Architecture

Database Schema

```
sql
```

-- Core Tables

```
CREATE TABLE users (  
  id UUID PRIMARY KEY DEFAULT gen_random_uuid(),  
  email VARCHAR(255) UNIQUE NOT NULL,  
  encrypted_settings JSONB,  
  created_at TIMESTAMP WITH TIME ZONE DEFAULT NOW(),  
  updated_at TIMESTAMP WITH TIME ZONE DEFAULT NOW()  
);
```

```
CREATE TABLE tasks (  
  id UUID PRIMARY KEY DEFAULT gen_random_uuid(),  
  user_id UUID REFERENCES users(id) ON DELETE CASCADE,  
  parent_id UUID REFERENCES tasks(id) ON DELETE CASCADE,  
  title VARCHAR(500) NOT NULL,  
  content JSONB, -- Encrypted rich text content  
  status VARCHAR(50) DEFAULT 'pending',  
  priority INTEGER DEFAULT 0,  
  due_date TIMESTAMP WITH TIME ZONE,  
  completed_at TIMESTAMP WITH TIME ZONE,
```

-- Scheduling

```
scheduled_for TIMESTAMP WITH TIME ZONE,  
duration_minutes INTEGER,
```

-- Recurrence

```
recurrence_pattern JSONB,  
recurrence_parent_id UUID REFERENCES tasks(id),
```

-- AI Context

```
ai_context JSONB, -- Encrypted AI suggestions/context  
embedding VECTOR(384), -- For semantic search
```

-- Metadata

```
tags TEXT[],  
dependencies UUID[],  
position REAL, -- For ordering
```

-- Versioning

```
version INTEGER DEFAULT 1,  
version_history JSONB[],
```

-- Timestamps

```
created_at TIMESTAMP WITH TIME ZONE DEFAULT NOW(),  
updated_at TIMESTAMP WITH TIME ZONE DEFAULT NOW(),  
deleted_at TIMESTAMP WITH TIME ZONE,
```

```
-- Indexes
```

```
INDEX idx_user_status (user_id, status),  
INDEX idx_due_date (due_date),  
INDEX idx_scheduled (scheduled_for),  
INDEX idx_position (user_id, position)
```

```
);
```

```
CREATE TABLE sync_log (  
  id UUID PRIMARY KEY DEFAULT gen_random_uuid(),  
  user_id UUID REFERENCES users(id) ON DELETE CASCADE,  
  device_id VARCHAR(255) NOT NULL,  
  operation VARCHAR(50) NOT NULL,  
  entity_type VARCHAR(50) NOT NULL,  
  entity_id UUID NOT NULL,  
  changes JSONB NOT NULL,  
  vector_clock JSONB NOT NULL,  
  synced_at TIMESTAMP WITH TIME ZONE DEFAULT NOW(),
```

```
  
  INDEX idx_sync_user_device (user_id, device_id, synced_at)  
);
```

```
CREATE TABLE automation_rules (  
  id UUID PRIMARY KEY DEFAULT gen_random_uuid(),  
  user_id UUID REFERENCES users(id) ON DELETE CASCADE,  
  name VARCHAR(255) NOT NULL,  
  trigger_type VARCHAR(50) NOT NULL,  
  trigger_config JSONB NOT NULL,  
  action_type VARCHAR(50) NOT NULL,  
  action_config JSONB NOT NULL,  
  is_active BOOLEAN DEFAULT true,  
  last_triggered_at TIMESTAMP WITH TIME ZONE,  
  created_at TIMESTAMP WITH TIME ZONE DEFAULT NOW(),
```

```
  
  INDEX idx_automation_active (user_id, is_active)  
);
```

```
-- Materialized Views for Performance
```

```
CREATE MATERIALIZED VIEW task_statistics AS  
SELECT
```

```
user_id,  
DATE_TRUNC('day', created_at) as date,  
COUNT(*) as total_tasks,  
COUNT(CASE WHEN status = 'completed' THEN 1 END) as completed_tasks,  
AVG(EXTRACT(EPOCH FROM (completed_at - created_at))/3600)::INTEGER as avg_completion_hours  
FROM tasks  
GROUP BY user_id, DATE_TRUNC('day', created_at);  
  
CREATE INDEX idx_task_stats ON task_statistics(user_id, date);
```

Data Flow Patterns

Create Task Flow

1. User Input → Local LLM Parser
2. Parse Results → Task Object Creation
3. Encrypt Sensitive Fields → IndexedDB Save
4. Queue Sync Operation → Background Sync Worker
5. Sync to Supabase → Real-time Broadcast
6. Update Other Devices → Conflict Resolution

Sync Flow

1. Local Change Detection → Version Vector Update
2. Diff Calculation → Compressed Delta
3. Encrypted Upload → Supabase Transaction
4. Real-time Notification → Connected Clients
5. Conflict Detection → CRDT Merge
6. Local State Update → UI Refresh

2.3 Security Architecture

Encryption Model

javascript

// Client-Side Encryption Architecture

```
{
  "masterKey": {
    "derivation": "PBKDF2",
    "iterations": 1750000,
    "salt": "user-specific-salt",
    "length": 256
  },
  "dataEncryption": {
    "algorithm": "AES-256-GCM",
    "ivLength": 16,
    "tagLength": 16
  },
  "keyRotation": {
    "frequency": "90 days",
    "versioning": true,
    "backwardCompatible": true
  },
  "storageKeys": {
    "local": "encrypted-with-device-key",
    "cloud": "encrypted-with-master-key",
    "shared": "encrypted-with-derived-key"
  }
}
```

Authentication Flow

1. User Login Request

- └─ Email/Password → Supabase Auth
- └─ OAuth Provider → Provider Auth → Supabase
- └─ Magic Link → Email Verification → Supabase

2. Token Management

- └─ Access Token (15 min) → API Requests
- └─ Refresh Token (7 days) → Token Renewal
- └─ Session Cookie (httpOnly, secure, sameSite)

3. Authorization

- └─ JWT Claims Validation
- └─ Resource Ownership Check
- └─ Rate Limiting per User

2.4 Technology Stack

yaml

Frontend:

- React 18.2 with TypeScript
- Vite 5.0 build tool
- Tiptap 2.0 editor
- Zustand state management
- Tailwind CSS 3.4
- Shadcn/ui components

Backend:

- Next.js 14 API routes
- Vercel Edge Functions
- Supabase PostgreSQL
- Supabase Realtime

AI/ML:

- Ollama local runtime
- Mistral-7B model
- Claude connector API

DevOps:

- GitHub Actions CI/CD
- Vercel deployment
- Sentry monitoring
- Playwright testing

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