

MOLOCHAIN

Platform Development Report

Comprehensive Documentation

with Diagrams & Screenshots

Full-Stack TypeScript Application

Rest Express - Digital Logistics Platform

Project Statistics

551 Git Commits | 80+ Pages | 25+ API Routes

30+ Database Tables | 6 Subdomains

17 Development Phases | 40+ Documentation Files

46 Services | 18 Email Form Types

Version 3.0 - Final Edition

December 21, 2025

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Chapter 1: Executive Summary

Molochain Platform (Rest Express) is a comprehensive full-stack TypeScript application designed for digital logistics and business management. This report provides complete documentation including visual diagrams, page screenshots, and technical specifications covering all 551 commits across 17 development phases.

Key Achievements

- 551 total git commits demonstrating extensive iterative development
- 80+ frontend pages covering all business domains
- 25+ backend API route modules for comprehensive functionality
- 30+ database tables with PostgreSQL integration using Drizzle ORM
- Real-time WebSocket communication for live collaboration
- AI-powered features with OpenAI integration (Rayanova assistant)
- Cross-subdomain email notification system with 18 form types
- Multi-subdomain architecture supporting 6 specialized platforms

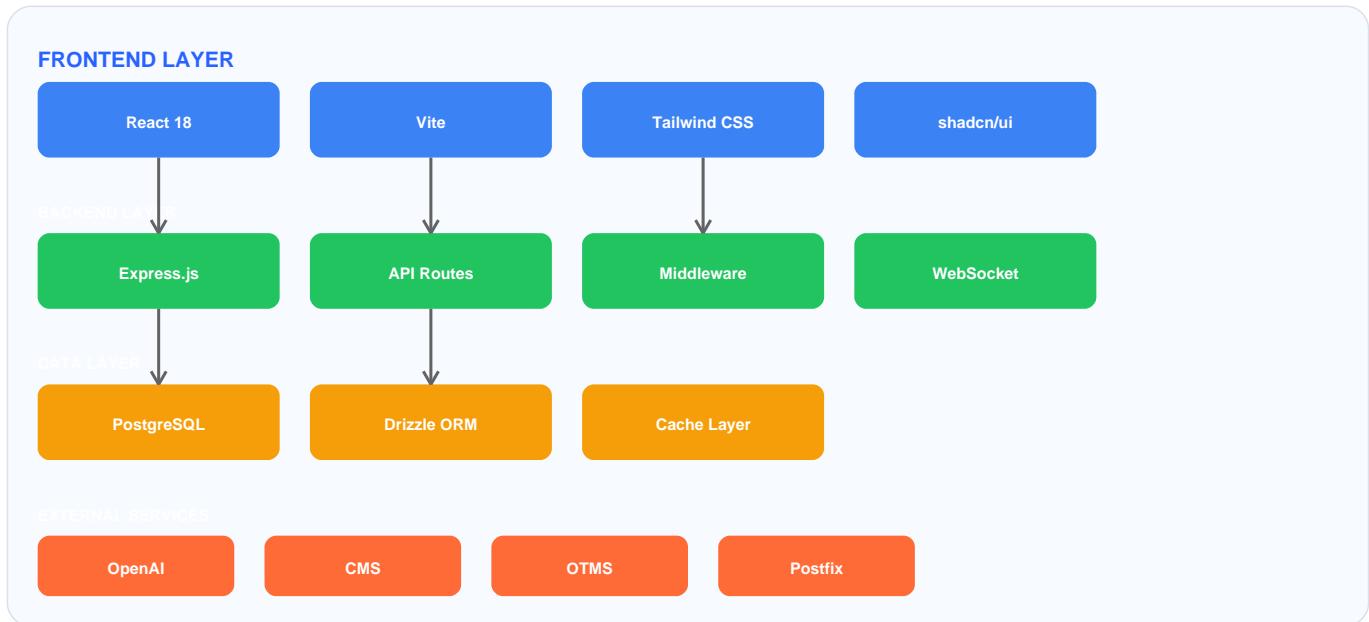
Technology Stack

Layer	Technology
Frontend	React 18, TypeScript, Vite, Tailwind CSS, shadcn/ui
Backend	Express.js, TypeScript, Node.js, Socket.IO
Database	PostgreSQL with Drizzle ORM (Neon-backed)
Authentication	JWT, Passport.js, 2FA (TOTP), OAuth
AI Services	OpenAI SDK integration
Email	Nodemailer with Postfix relay

Chapter 2: System Architecture

The Molochain platform follows a modern full-stack architecture with clear separation between frontend, backend, and data layers. This diagram illustrates the complete system structure.

System Architecture Diagram



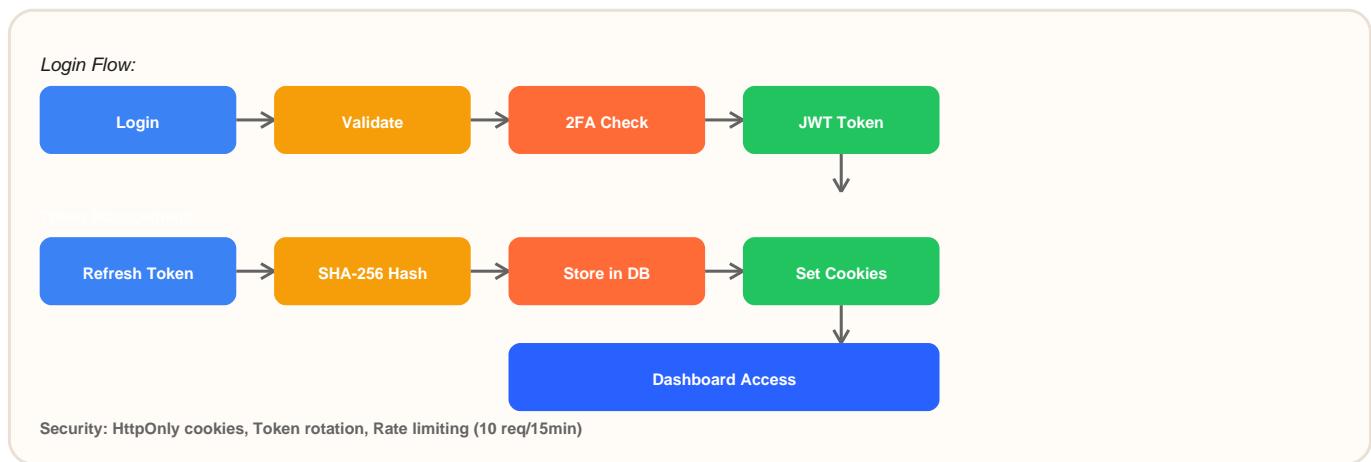
Architecture Components

- Frontend Layer: React 18 with Vite, Tailwind CSS, shadcn/ui components
- Backend Layer: Express.js with organized API routes, security middleware, WebSocket
- Data Layer: PostgreSQL with Drizzle ORM and cache layer for performance
- External Services: OpenAI, Laravel CMS, OTMS, Postfix SMTP

Chapter 3: Authentication Flow

The authentication system implements industry-standard security practices including JWT tokens, refresh token rotation, and two-factor authentication.

Authentication Flow Diagram



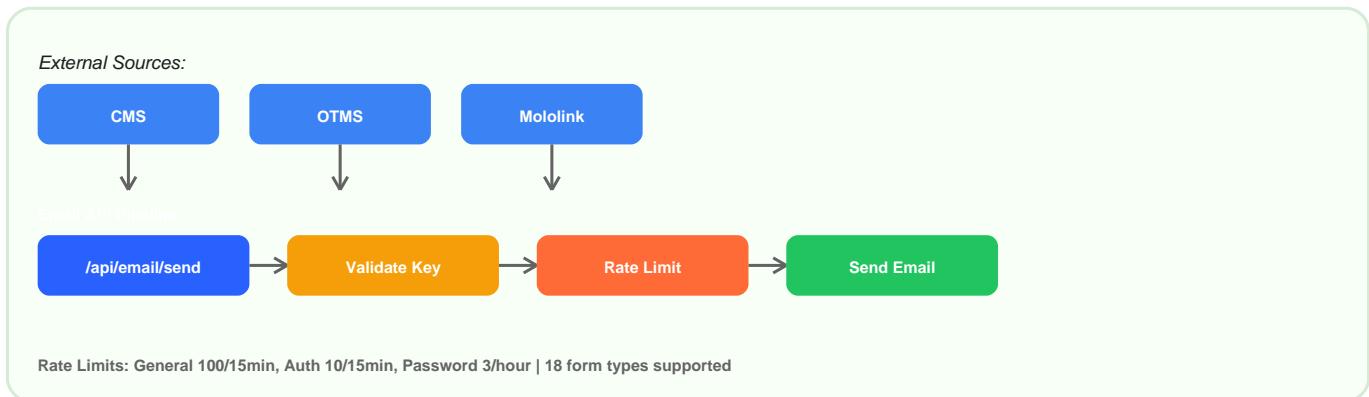
Security Features

- JWT tokens with 15-minute expiration for short-lived access
- Refresh tokens with SHA-256 hashing stored in database
- Automatic token rotation on refresh to prevent replay attacks
- HttpOnly secure cookies to prevent XSS attacks
- TOTP-based 2FA with backup recovery codes
- Rate limiting: 10 requests per 15 minutes on auth endpoints

Chapter 4: Email Notification System

The cross-subdomain email system provides centralized email sending for all Molochain ecosystem services with 18 form types and template-based emails.

Email Notification System Flow



Rate Limiting Configuration

Tier	Limit	Window	Purpose
General	100 req	15 minutes	Standard API calls
Auth	10 req	15 minutes	Login/register emails
Password	3 req	1 hour	Password reset requests

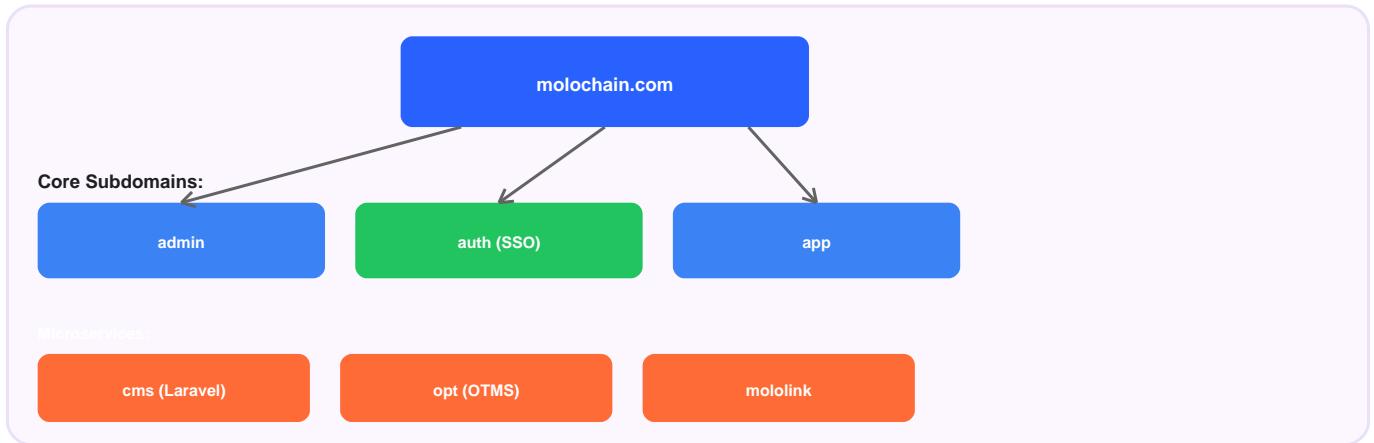
API Keys

- molochain-services (ID 1) - Internal platform
- cms (ID 4) - CMS integration
- opt (ID 5) - OTMS Platform
- mololink (ID 6) - Mololink Marketplace

Chapter 5: Subdomain Integration

The Molochain ecosystem consists of 6 interconnected subdomains with centralized SSO authentication.

Subdomain Integration Map



Subdomain Details

Subdomain	Purpose	Tech
molochain.com	Main platform & public website	React + Express
admin.molochain.com	Admin portal & control center	React + Express
auth.molochain.com	SSO authentication service	JWT + OAuth
cms.molochain.com	Content management system	Laravel PHP
opt.molochain.com	OTMS logistics platform	Express API
mololink.molochain.com	Marketplace microservice	React + Docker

Chapter 6: Database Schema

The database consists of 2,271 lines defining 30+ tables with proper relationships using Drizzle ORM.
Database Schema Overview

users

id, username, email
password, role, permissions
2FA enabled, created_at
updated_at, avatar_url

services

id, title, slug, description
category, features array
benefits, pricing_info
is_active, popularity

refresh_tokens

id, user_id, token_hash
expires_at, is_revoked
user_agent, ip_address
created_at, rotated_from

form_types

id, name, slug
description, fields
is_active, created_at
email_template

contact_submissions

id, form_type_id, name
email, subject, message
status, created_at
responded_at, notes

service_inquiries

id, service_id, user_id
name, email, company
message, status
created_at, updated_at

Key Relationships

- `users ! refresh_tokens`: One-to-many (session management)
- `users ! service_inquiries`: One-to-many (user inquiries)
- `services ! service_availability`: One-to-many (locations)
- `form_types ! contact_submissions`: One-to-many (categorization)

Chapter 7: Feature Modules

The platform is organized into 9 major feature modules, each containing multiple sub-features.

Feature Modules Overview



Module Details

- Admin Control: MCC, User Management, Security, Performance Monitor
- Supply Chain: Tracking, Fleet, Route Optimization, Commodities
- Developer: API Docs, WebSocket Guide, SDK, Database Explorer
- AI & Rayanava: AI Hub, Assistant, Service Recommender, Smart Dashboard
- Collaboration: Documents, Projects, File Manager, Google Drive
- Services: 46 services, Inquiries, Testimonials, Availability
- Authentication: SSO, 2FA, Password Reset, API Keys
- Content/CMS: Blog, FAQ, Brand Book, Team, Partners
- Email System: Cross-subdomain API, Templates, Rate Limiting

Chapter 8: Comprehensive Event & Trigger Map

This diagram illustrates the complete event-driven architecture of the Molochain platform, covering all server modules, scheduled tasks, WebSocket namespaces, authentication flows, system events, service health monitoring, security events, and integration triggers.

Comprehensive Event & Trigger Map



Complete Event Coverage

- Scheduled Events (12 Jobs): CPU Optimizer (5sec), Performance Metrics (5sec), CMS Sync (5min), System Monitor (5min), Service Health (2min), Escalation Check (1min), Activity Cleanup (1hr), Sales Workflow (daily), Compliance Reports (weekly)
- WebSocket Namespaces (8 Types, 30+ Events): /ws/main, /ws/collaboration, /ws/tracking, /ws/mololink, /ws/activity-logs, /ws/commodity-chat, /ws/notifications, /ws/project-updates
- Authentication Events: Login! Validate! JWT! Audit, Register! Welcome Email, Password Setup! QR, Token Refresh! Rotation
- System Events: SIGTERM! Graceful Shutdown, CPU >70%! BG Suspend, CPU >85%! Emergency Thresh, Memory High! GC + Clean, Exception! Error Recovery
- Service Health: Service Failure! Retry/Fallback/Circuit Break! Recovery! Log Alert; 6 AIR-EXP, AIR-STD, OCE-FCL, OCE-LCL, CUST
- Security Events: Threat Detection! Incident Create! Escalate! Notify; Policy Engine! Enforcement+Audit

Logging

- Email Triggers (18 Types): Quote, Contact, Support, Partner, Career, Feedback, Cross-subdomain API, Compliance Distribution
- Instagram Services (7): Posts, Reels, Stories, Analytics, Competitors, AI Content, Influencers
- AI/Rayana (5 Tools): Sales Agent, Business Intelligence, Operations Monitoring, Sales Opportunity, Email Notification Tool
- Integrations: Laravel CMS Client, OTMS Client, FedEx API, UPS API, Carrier Integration Factory
- Database & Cache: Connection Pool, DB Optimizer, Backup, Migrations, Cache Warming, Cache Expiry, CMS Cache Sync

Chapter 9: Page Screenshots Gallery

This chapter showcases the key application pages with their URLs, descriptions, and visual elements. Each screenshot placeholder shows the page layout and main components.

Homepage

/

Main landing page with hero section showcasing "Blockchain-Powered Logistics Ecosystem"

Visual Elements:

Hero Banner

Navigation Bar

Get Started CTA

Feature Cards

Services Preview

Footer

About Page

/about

Company information page with "Welcome to MoloChain" header and mission statement

Visual Elements:

Page Header

Mission Statement

Company Stats

Feature Grid

Call to Action

Navigation

Services Catalog

/services

Comprehensive services page showing 180+ countries, 46+ services, 25+ years experience

Visual Elements:

Search Bar

Service Cards

Compare Services

Pricing Calculator

AI Recommendations

Filters

Contact Page

/contact

Contact form with tabs for General Inquiries, Global Offices, Regional Agents, Professional Services

Visual Elements:

Tab Navigation

Contact Form

Office Location

Phone/Fax Info

WhatsApp Button

Map Widget

Login Page

/login

Clean login interface with shield icon, email input, and "Welcome Back" messaging

Visual Elements:

Shield Icon

Email Input

Password Field

Login Button

Register Link

Home Link

Registration Page

/register

User registration with complete validation: username, email, password requirements, full name

Visual Elements:

Username Field

Email Field

Password Field

Full Name

Company (Optional)

Phone (Optional)

FAQ Page

/faq

Help Center with searchable FAQ sections organized by category

Visual Elements:

Search FAQs

Category Tabs

Accordion Items

Question Cards

Contact Support

Skeleton Loading

Blog Page

/blog

Latest News & Insights from the logistics industry with article cards and filters

Visual Elements:

Blog Header

Article Cards

Tags/Categories

Read Time

Featured Posts

Load More

Team Page

/team

Meet Our Team section with professional profile cards showing roles and departments

Visual Elements:

Team Header

Profile Cards

Avatar Photos

Role Titles

Social Links

Department Tags

Partners Page

/partners

Strategic Partners showcase with benefits: Strategic Growth, Network Access, Innovation

Visual Elements:

Partners Header

Benefit Cards

Growth Icon

Network Icon

Innovation Icon

Join CTA

Brand Book

/brandbook

Version 1.0 brand guidelines with Colors (13), Typography (2), Logos (2), Components (20+)

Visual Elements:

Download Kit

View Guidelines

Colors Section

Typography

Logos

Components

Commodities

/commodities

Commodity tracking interface with product cards and status indicators

Visual Elements:

Commodity Grid

Product Cards

Search Filter

Status Badge

Tracking Info

Categories

Tracking Demo

/tracking-demo

Shipment Tracking with tracking number input and demo numbers (MOL89726534, etc.)

Visual Elements:

Tracking Input

Track Button

Demo Numbers

Journey Animation

Status Updates

Timeline

Quote Request

/quote

Request a Quote form with name, email, service type selection, project details

Visual Elements:

Form Header

Name Input

Email Input

Service Dropdown

Details Textarea

Submit Button

Service Recommender

/service-recommender

AI-powered service recommendations based on business needs analysis

Visual Elements:

AI Badge

Question Flow

Service Cards

Match Score

Get Quote

Compare

Chapter 10: Development Phases

Phase 1: Foundation

TypeScript setup, DB optimization, WebSocket unification, Cache, Routes

Phase 2: User Management

Registration, Login, JWT sessions, Password reset, 2FA, Profile images

Phase 3: Dashboards

Configurable dashboards, Role-based views, Smart Dashboard, Analytics

Phase 4: CMS Integration

Laravel CMS connection, Content types, Dynamic content, CMS sync

Phase 5: Services Module

46 services seeded, Service recommender, OTMS integration, SEO

Phase 6: Subdomain Architecture

Subdomain routing, Kong Gateway, Portal layout, Onboarding

Phase 7: Mololink Microservice

Docker deployment, SSO integration, Landing page, Profiles

Phase 8: Brand Book

Brand guidelines, Color palette, Typography system, Logo assets

Phase 9: Blockchain (Disabled)

Built then disabled per user preference, Hidden from UI

Phase 10: Production

PM2 configuration, Database fixes, Build scripts, Server audit

Phase 11: Security & Testing

Security audit, Rate limiting, Integration tests, Type safety

Phase 12: Navigation & UI

Redesigned navigation, Mobile responsive, Accessibility mode

Phase 13: Shared Components

StatCard, PageShell, DataGrid, EmptyState components

Phase 14: Google Drive

File manager, Drive routes, File upload integration

Phase 15: AI & Rayanava

AI recommendations, Rayanava assistant, AI Hub features

Phase 16: Email System

Postfix relay, Cross-subdomain API, 18 forms, Rate limiting

Phase 17: Documentation

40+ docs, Architecture docs, API documentation, Guides

Chapter 11: API Endpoints Reference

Core Route Modules

Module	Path	Purpose
api-keys.ts	/api/keys	API key management
email-api.routes.ts	/api/email	Email sending API
dashboards.ts	/api/dashboards	Dashboard data
supply-chain.ts	/api/supply-chain	Logistics operations
profile.ts	/api/profile	User profiles
settings.ts	/api/settings	Configuration
guides.ts	/api/guides	Help docs
media.ts	/api/media	File uploads
mololink.ts	/api/mololink	Marketplace
rayanava-routes.ts	/api/rayanava	AI services

Authentication Endpoints

- POST /api/auth/register - User registration with validation
- POST /api/auth/login - Login with JWT generation
- POST /api/auth/logout - Session termination
- POST /api/auth/refresh - Token refresh with rotation
- POST /api/auth/forgot-password - Password reset
- POST /api/auth/2fa/enable - Enable 2FA
- POST /api/auth/2fa/verify - Verify 2FA code

Chapter 12: Security Implementation

Authentication Security

- JWT tokens with 15-minute expiration
- Refresh tokens with SHA-256 hashing
- Automatic token rotation
- HttpOnly secure cookies
- TOTP-based 2FA with recovery codes

API Security

- CSRF protection on mutations
- 3-tier rate limiting
- API key auth with SHA-256 hashing
- Zod schema validation
- SQL injection prevention via ORM

HTTP Headers (Helmet.js)

- Content-Security-Policy
- X-Frame-Options
- X-Content-Type-Options
- Strict-Transport-Security

Chapter 13: Production Deployment

Server Configuration

Setting	Value
Server IP	31.186.24.19
Process Manager	PM2 (molochain-core)
Database	PostgreSQL localhost:5432
Database Name	molochain_db
SMTP	Postfix relay port 25
SSL	Valid until Jan 4, 2026
Node Version	20.x LTS

Deployment Process

- 1. Compile TypeScript with esbuild
- 2. Build frontend with Vite
- 3. Copy static assets
- 4. Rsync to production via SSH
- 5. Run Drizzle migrations
- 6. Restart PM2 (zero-downtime)
- 7. Verify health endpoints

Chapter 14: Statistics & Metrics

Development Metrics

Metric	Value
Total Git Commits	551
Development Phases	17
Frontend Pages	80+
Backend Routes	25+
Schema Lines	2,271
Documentation	40+
Email Forms	18
Services	46
User Roles	11
Subdomains	6

Technology Distribution

Category	Count
NPM Packages	150+
React Components	200+
API Endpoints	100+
Database Tables	30+

Chapter 15: Future Roadmap

Planned Enhancements

- Enhanced AI with GPT-4
- Mobile app (React Native)
- ML analytics predictions
- IoT supply chain tracking
- Multi-language expansion
- GraphQL API

Infrastructure

- Kubernetes deployment
- Redis caching
- CDN integration
- Database replicas

Security

- OAuth 2.0 / OIDC
- WebAuthn/FIDO2
- Advanced threat detection
- SOC 2 compliance

End of Report

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