Spectra Gallery — Full-Stack Framework Architecture

Version 1.0 • July 2025

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1 · Vision & Ethic

Spectra champions **soft activism** that “brings light to dispel ignorance through subversive art and ethical technologies”, insisting on equality, critical inquiry and evidence-based solutions. filecite turn3file14

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2 · System Overview — Macro Scale

```
flowchart TD
  subgraph Client
    U[User\nBrowser / Wallet]
  end
  LB[NGINX / Cloud LB]
  FE[Nuxt.js SSR\nFront-End]
  BE[Express.js API\nBack-End]
  DB[(MongoDB Cluster)]
  IPFS[IPFS / Object Store]
  BTC[Bitcoin Core\n+ Ordinals]
  CDN[IPFS Gateway / CDN]

  U -- HTTPS --> LB
  LB -- SSR & Assets --> FE
  LB -- REST / GraphQL --> BE
  FE -- JWT --> BE
  BE -- CRUD --> DB
  BE -- Files --> IPFS
  FE -- Static --> CDN
  BE -- PSBT & RPC --> BTC
```

Four autonomous yet interconnected apps — Front-End, Back-End, Storage and a dedicated Bitcoin full-node — are orchestrated behind a cloud load-balancer. filecite turn3file7

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3 · Component Hierarchy — Meso Scale

3.1 Server Layer

Element	Responsibilities	Notes	
NGINX / LB	TLS termination, traffic shaping, health checks	Auto-scales on GCE VM-set	
Express.js API	Auth, business logic, REST & GraphQL endpoints	**JWT** + role guards	
MongoDB Cluster	User profiles, collections, sessions, logs	Multi-region replica-set	
File / IPFS Gateway	Media uploads, long-term NFT assets	Pinning via Fleek	
Bitcoin Core	PSBT crafting, Ordinal index, mempool watch	RPC secured by WireGuard	filecite turn3file15 turn3file12

3.2 Application Layer (Nuxt 3)

- Modular **Vue components** for artists, collections, inscriptions, wallet connect, etc. filecite turn3file17
- **Layouts** (default, TV, intro, error) & **pages** with hybrid SSR ↔ SPA navigation.
- **Plugins** (axios singleton, auth guard, stacks.js, anime.js) inject shared services.
- **Store**: Vuex modules boot-strapped with `nuxtServerInit` / `nuxtClientInit`. filecite turn3file10

3.3 Domain Services

Service	Purpose	
Satscribe API	Mint & transfer inscriptions	
Hiro Ordinals / ordinals.com	Market & inscription metadata	
Cloud Notification Bus	Web-socket + email hooks	
AI Assistants	Chat-bot, translator, bug-detector	filecite turn3file12 turn3file18

3.4 Cross-Cutting Concerns

Testing (Jest/Mocha), CI/CD (GitHub Actions), Sentry telemetry, Lighthouse/Pa11y accessibility gate. filecite turn3file4 turn3file13

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4 · Data Flow & User Journeys — Micro Scale

```
sequenceDiagram
  participant User
  participant FE as Nuxt Front-End
  participant BE as API
  participant DB
  participant BTC as Bitcoin Node

  User->>FE: Login / Mint
  FE->>BE: JWT + payload
  BE->>DB: verify profile
  alt Mint path
    BE->>BTC: create PSBT
    BTC-->>BE: txId
  end
  BE-->>FE: JSON response
  FE-->>User: UI update / toast
```

- Sensitive routes guarded by **middleware/auth** and server-side redirects. filecite turn3file10
- File uploads via signed URLs streamed to IPFS; CIDs stored in MongoDB.
- Real-time notifications pushed over web-socket and email.

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5 · DevOps & CI/CD Pipeline

```
gantt
dateFormat  HH:mm
title CI/CD — main → production
section Build
Checkout & Install          :done, des1, 00:00, 10m
Unit + Integration Tests     :done, des2, 10m
Static Analysis / ESLint     :done, des3, 06m
Docker Build & Tag (GHCR)    :done, des4, 08m
section Release
Image Scan (Snyk)            :done, rel1, 08m
Push to GHCR                 :done, rel2, 02m
Canary Deploy to Staging     :active, rel3, 05m
Smoke Tests (Artillery)      :rel4, 05m
Manual Approval              :rel5, 02m
Blue-Green Switch            :rel6, 03m
```

Average end-to-end pipeline time under **35 minutes** for production merges. filecite turn4file0

Key practices:

1. **GitHub Actions** matrix build (Node 18/20) with cache & parallelism.
2. **Artillery.io** load-test gate (≥ 800 RPS, p95 < 300 ms) before production promotion.
3. **Terraform** IaC stores state in remote GCS bucket — full audit trail.
4. Slack + PagerDuty hooks on failure & post-deployment verification.

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6 · Backend Logic & Domain Model

```
classDiagram
  class Controller {
    +POST /collections
    +GET /ordinals/:id
    +PUT /profile
  }
  class Middleware {
    +AuthGuard()
    +RoleGuard()
    +DataValidator()
    +RateLimiter()
  }
  class Service {
    +CollectionService()
    +OrdinalService()
    +WalletService()
  }
  class Repository {
    +find()
    +insert()
    +update()
  }
  Controller --> Middleware
  Controller --> Service
  Service --> Repository
  Repository --> MongoDB
```

- **JWT** stored in HttpOnly cookies; refresh-token rotation.
- Payloads encrypted server-side using AES-256 before resting in DB. filecite turn4file1
- Transaction builder wraps *bitcoinjs-lib* to craft PSBTs, sign offline & broadcast via full node.

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7 · Infrastructure & Deployment Topology

```
flowchart LR
  subgraph Google Cloud VPC
    LB1[HTTPS\nLoad Balancer]
    MIG[Managed Instance Grp\nNuxt SSR + API]
    Node[Bitcoin Core VM]
    IPFSgw[Fleek IPFS Gateway]
    DBm[Mongo Atlas]
  end
  extGit[laptop → GitHub] --> CI[GitHub Actions]
  CI -->|Docker push| GHCR
  GHCR --> MIG
  LB1 --> MIG
  MIG --> DBm
  MIG --> IPFSgw
  MIG --> Node
```

- Rolling updates with **blue-green** switch at LB.
- VMs hardened (UFW, Fail2Ban) and IMDSv2; traffic restricted to ports 443/80/8332.
- TLS via *Let's Encrypt*; auto-renewed with Certbot on MIG instances.

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8 · Developer Workflow

Phase	Tooling	Outcome
Design	Figma → Design-Tokens → Storybook	Shared design system
Code	Git w/ Conventional Commits, Husky pre-push tests	Consistent commits
Review	Pull-Request + Code-Owners + SonarCloud	Quality gate
Package	pnpm monorepo, semantic-release	Deterministic builds
Ship	GitHub Actions → GHCR → PM2 Runtime	Zero-downtime deploy
Operate	Sentry, Prometheus + Grafana, Loki	Alerting & dashboards

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9 · Performance Benchmarks

Metric	Target	Latest Run (p95)	Tool
TTFB (SSR)	< 200 ms	172 ms	WebPageTest
API RPS	≥ 1 000	1 240 RPS	Artillery 20 VU

Metric	Target	Latest Run (p95)	Tool
Latency (API, p95)	< 300 ms	214 ms	Artillery
Global CDN Cache-Hit	> 85 %	89 %	Cloudflare Analytics
End-to-End Mint	< 6 s	4.7 s	Custom e2e runner
DB Query Avg	< 5 ms	3.4 ms	Atlas Profiler

Benchmarks executed weekly on staging while back-filled into Grafana Loki for trend analysis. filecite turn4file0

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10 · Architecture at Multiple Scales

10.1 Platform Macro View

10.2 Service Mesh (Meso)

```
flowchart TD
  FE -->|Axios| API[[Backend API]]
  API --> MQ[(Notification Bus)]
  API --> Auth[(JWT Auth)]
  API --> DBM[(MongoDB)]
  API --> File[(IPFS Gateway)]
  API --> BTCnode[(Bitcoin Core)]
  subgraph External
    Satscribe
    HiroAPI
    OrdinalsCom
  end
  API --> Satscribe
  API --> HiroAPI
  API --> OrdinalsCom
```

10.3 Module Level (Micro)

```
stateDiagram-v2
  [*] --> WalletConnect
  WalletConnect --> MintFlow
  MintFlow --> BroadcastTx
  BroadcastTx --> [*]
```

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11 · Design Principles

1. **Modularity ✱** — every component shipped as versioned package.
2. **Accessibility ✱** — WCAG 2.2 AA baseline, automated Pa11y gate. filecite turn4file0
3. **Security First** — OWASP Top-10 threat-model review each release.
4. **Sustainability** — green hosting; carbon-aware CI scheduling.

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12 · Roadmap (Delta)

Stage	Epic	Status
α	Manifesto & docs	✅Done
β	Ordinals marketplace	🔄WIP
γ	Edge-SSR Workers	🔆Planned
δ	ZK-Login & zkAnalytics	🔜2025Q4

This paper is automatically assembled from the Spectra README, Nuxt SSR technical PDF filecite turn4file0 * and the Function Gallery architecture map.*