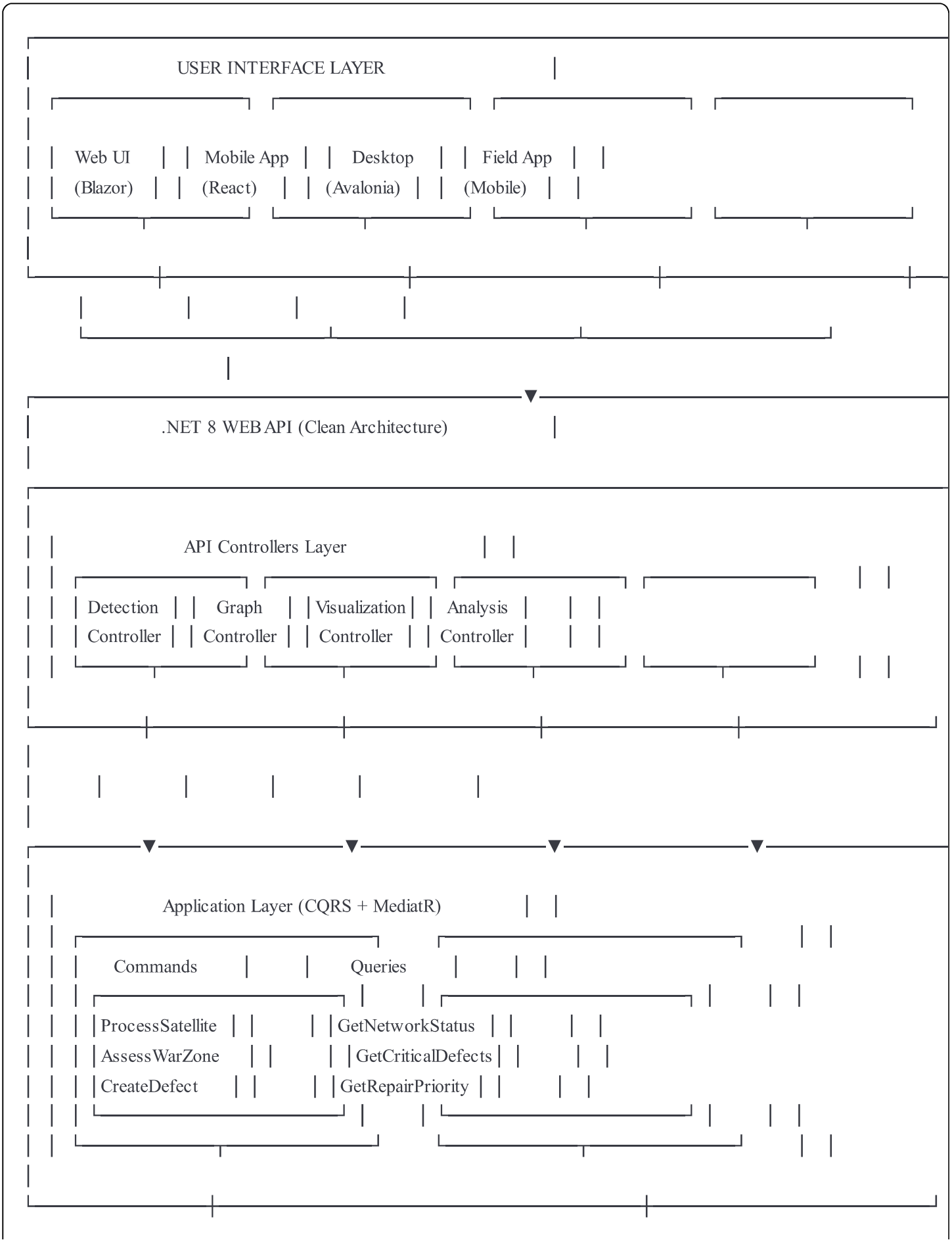
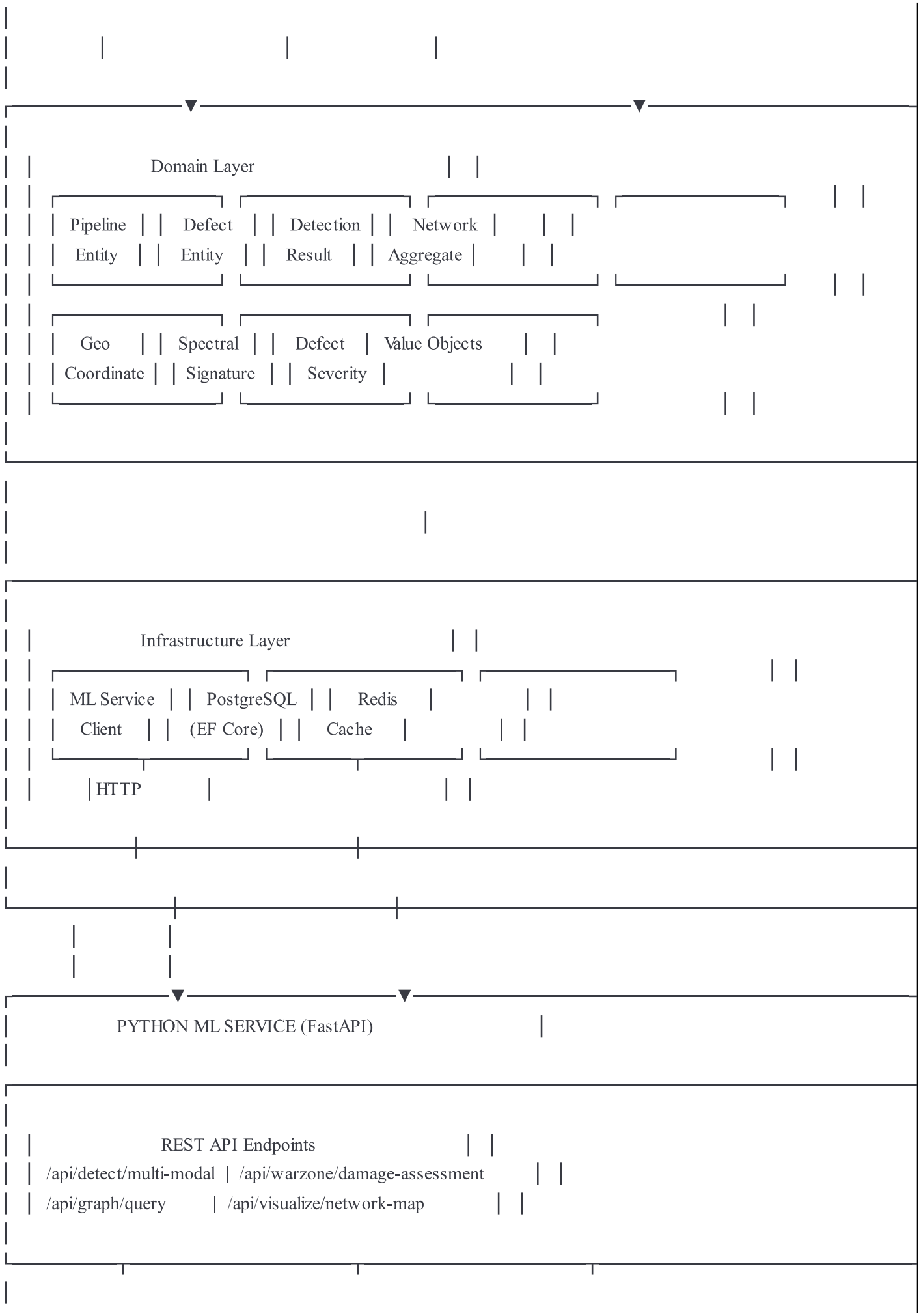
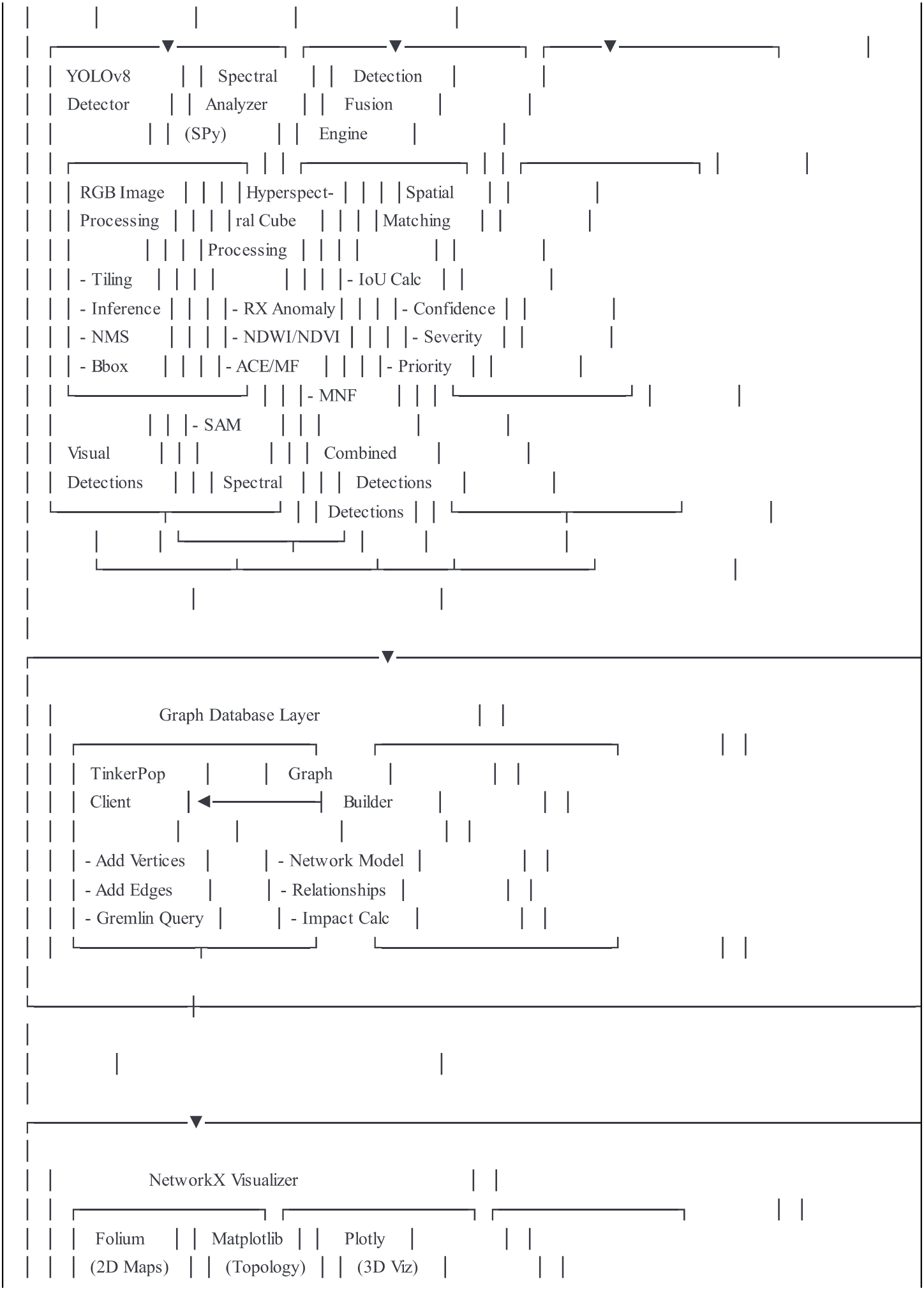
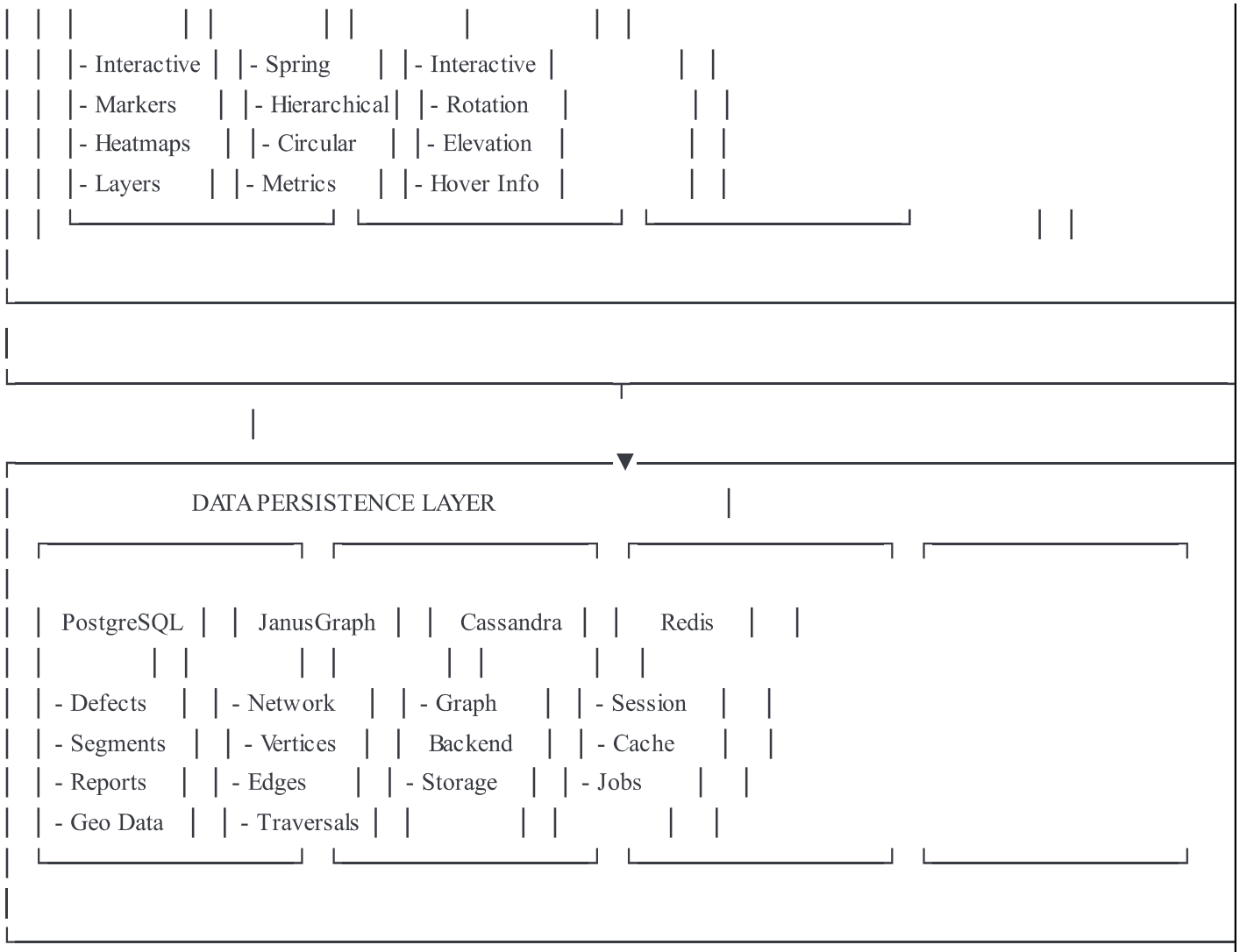
WPDD Advanced - System Architecture Diagram

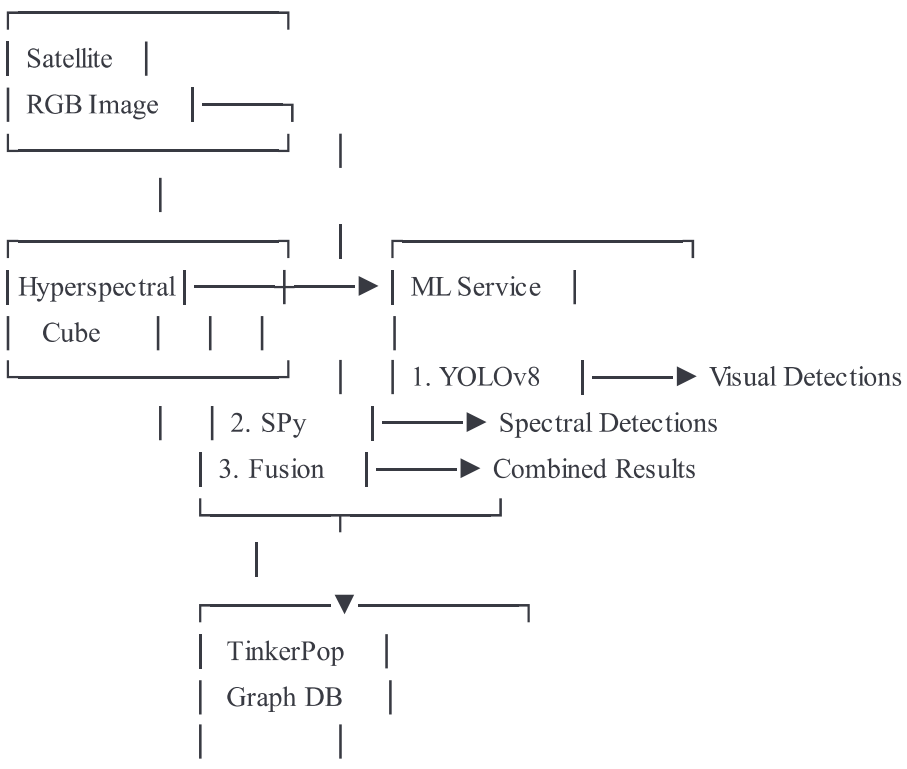


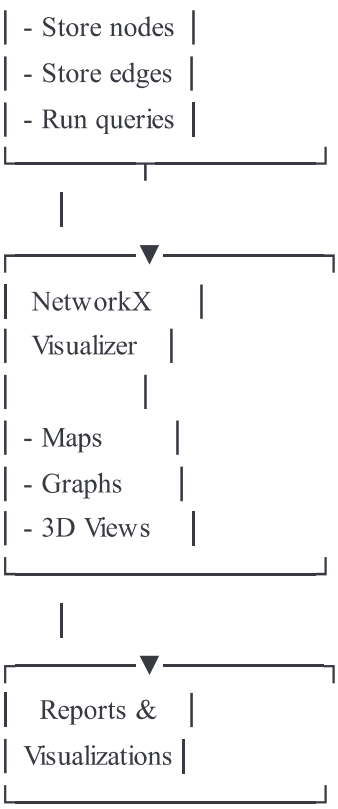

Domain Layer
Pipeline Entity
Defect Entity
Detection Result
Network Aggregate
Geo Coordinate
Spectral Signature
Defect Severity
Value Objects
Infrastructure Layer
ML Service Client
PostgreSQL (EF Core)
Redis Cache
HTTP
PYTHON ML SERVICE (FastAPI)
REST API Endpoints
/api/detect/multi-modal
/api/warzone/damage-assessment
/api/graph/query
/api/visualize/network-map


YOLOv8 Detector
Spectral Analyzer (SPy)
Detection Fusion Engine
RGB Image Processing
Hyperspectral Cube Processing
Spatial Matching
- Tiling
- Inference
- NMS
- Bbox
- SAM
- RX Anomaly
- NDWI/NDVI
- ACE/MF
- MNF
- IoU Calc
- Confidence
- Severity
- Priority
Visual Detections
Spectral Detections
Combined Detections
Graph Database Layer
TinkerPop Client
Graph Builder
- Add Vertices
- Add Edges
- Gremlin Query
- Network Model
- Relationships
- Impact Calc
NetworkX Visualizer
Folium (2D Maps)
Matplotlib (Topology)
Plotly (3D Viz)



DATA FLOW EXAMPLE





Key Component Interactions

1. Detection Pipeline

User Upload → API → ML Service → YOLOv8 + SPy → Fusion → Graph → Response

2. War Zone Assessment

Before/After Images → Change Detection → Impact Analysis → Priority Ranking

3. Network Analysis

Graph Query → TinkerPop → NetworkX → Visualization → User

4. Real-time Monitoring

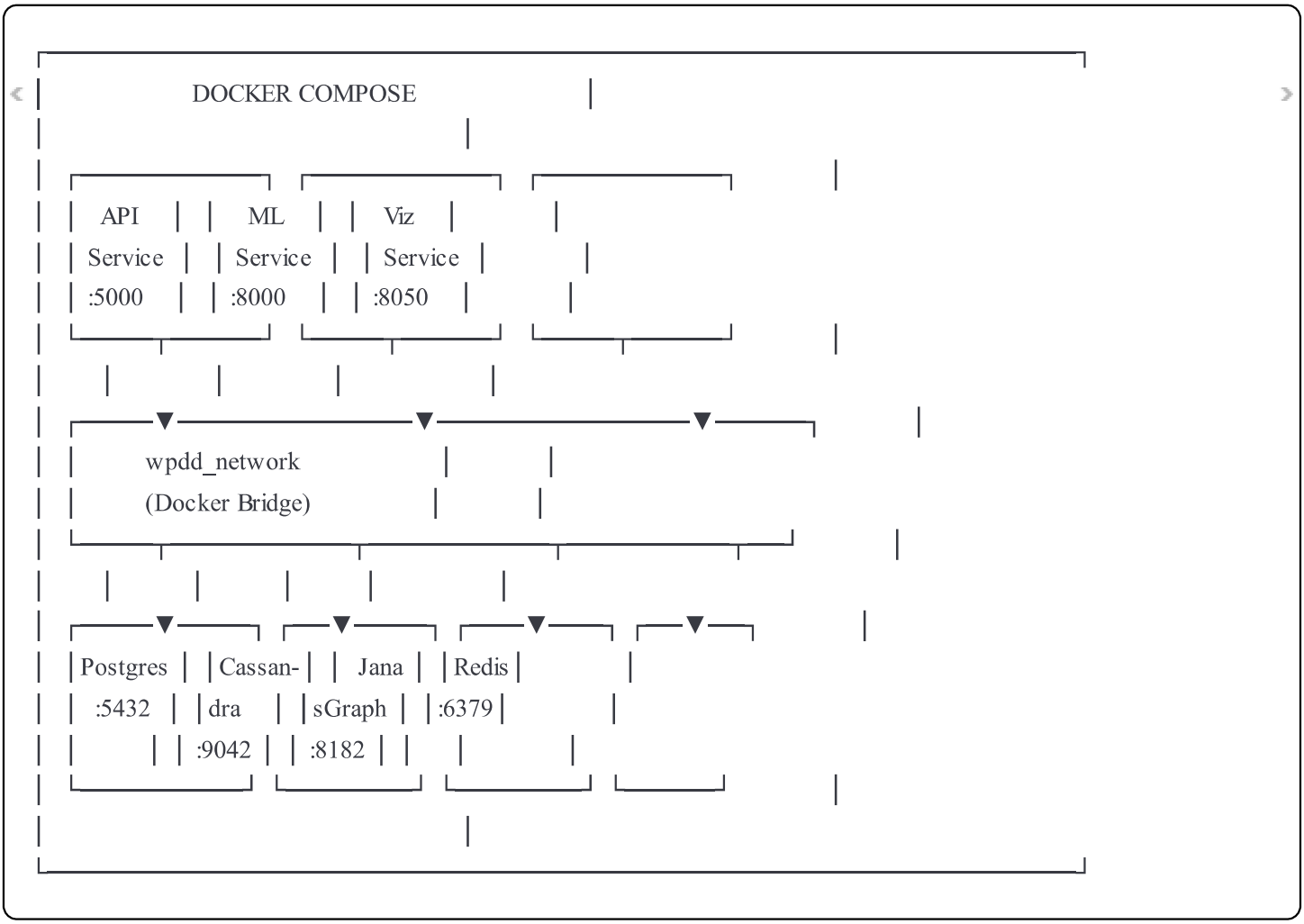
Satellite Feed → Auto-Detection → Alert Generation → Priority Notification

Technology Stack Summary

Layer	Technologies
Frontend	Blazor, React, Avalonia
Backend API	.NET 8, ASP.NET Core, MediatR

Layer	Technologies
ML Service	Python 3.11, FastAPI, Uvicorn
Detection	YOLOv8 (Ultralytics), PyTorch
Spectral	Spectral Python (SPy), NumPy, SciPy
Graph DB	JanusGraph, Apache TinkerPop, Gremlin
Visualization	NetworkX, Folium, Plotly, Matplotlib
Data Storage	PostgreSQL, Cassandra, Redis
Orchestration	Docker, Docker Compose
Architecture	Clean Architecture, DDD, CQRS

Deployment Architecture



This architecture provides:

- ✅ Horizontal scalability
- ✅ Service isolation
- ✅ Easy deployment

- ✅ Health monitoring
- ✅ Data persistence
- ✅ Network security