

Tolling System Architecture

A layered infrastructure connecting field devices, regional operations, and national clearing — end to end.



Field Devices

The detection layer — capturing every vehicle, every transaction.



LiDAR

Vehicle classification & length profiling



Radar

Speed detection & gap measurement



ANPR

Automatic number plate reading



RFID

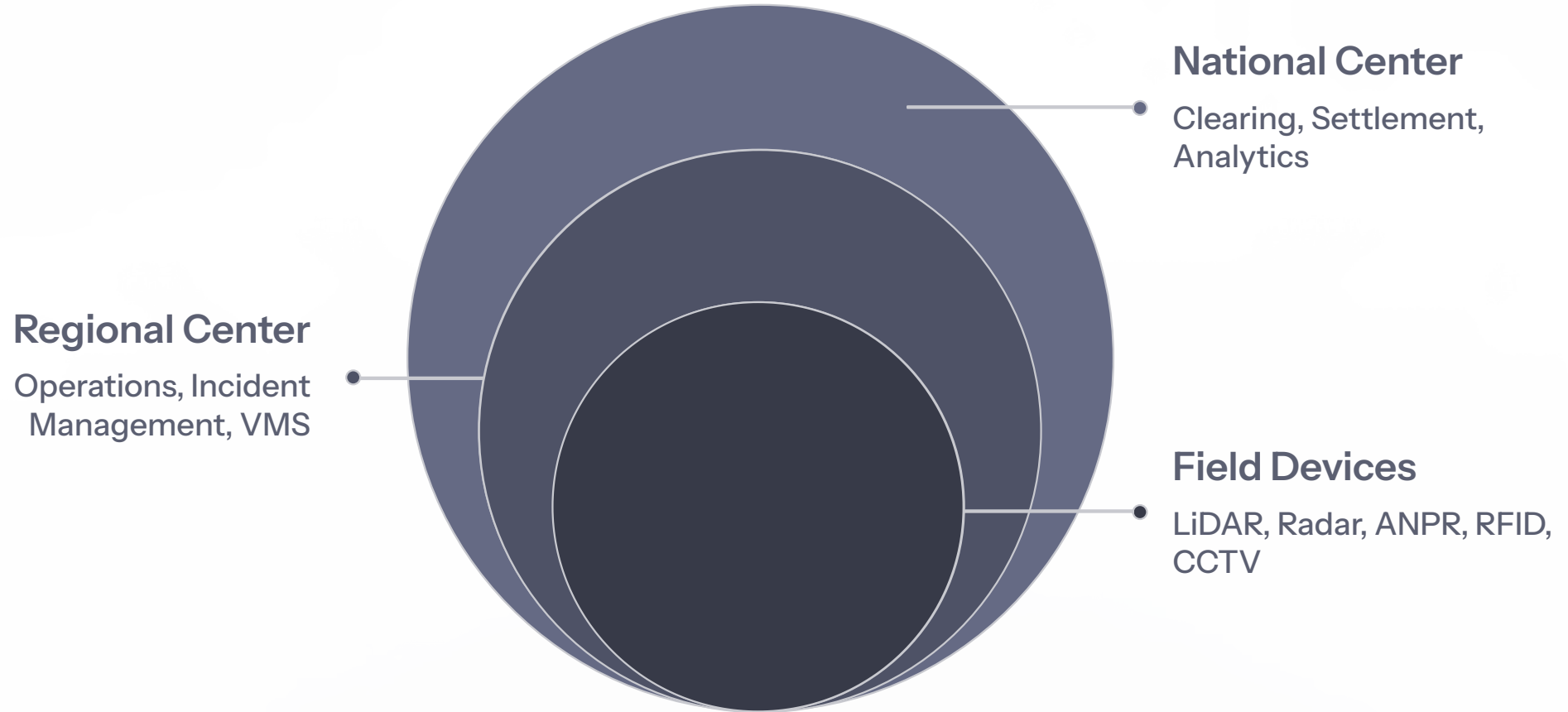
On-board unit transponder reads



CCTV

Visual verification & enforcement

Three-Tier Architecture



Data flows upward through each tier — from raw detection at the roadside to financial settlement at the national level.

TIER 2

Regional Center



Operations

Real-time lane status, transaction processing, equipment health monitoring

Incident Management

Event detection, crew dispatch, escalation protocols

VMS

Dynamic message sign control — tolls, alerts, diversions



TIER 3

National Center

Clearing

Interoperability matching
across operators and schemes

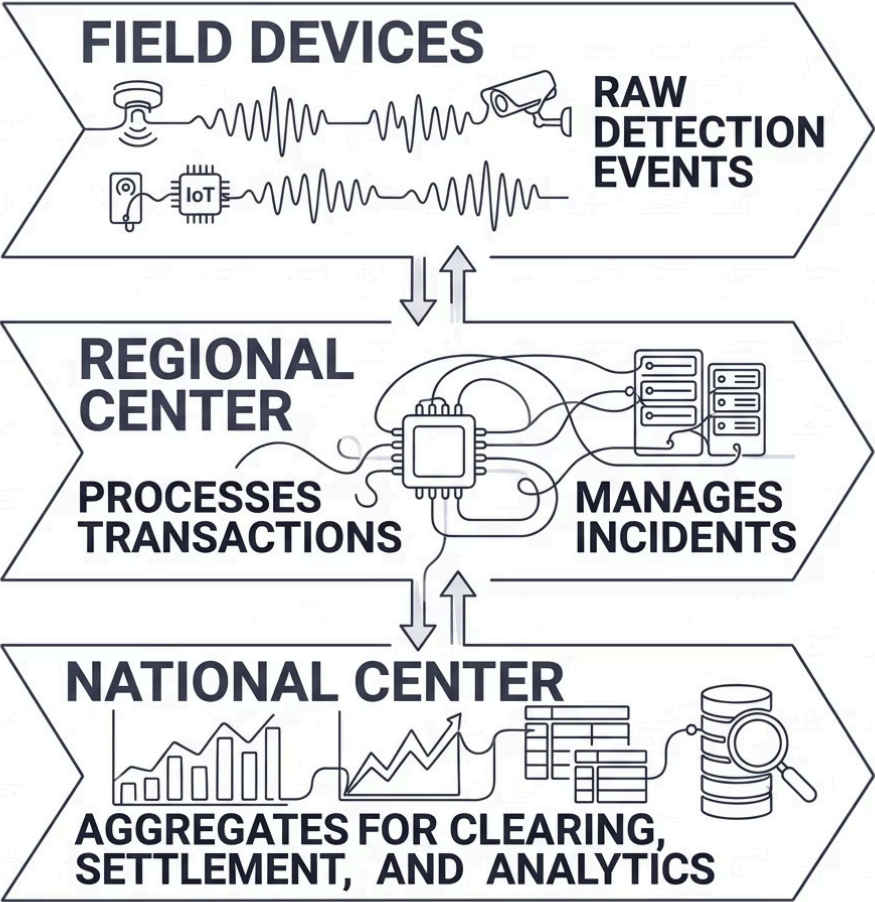
Settlement

Financial reconciliation,
invoicing, and payment
processing

Analytics

Network-wide reporting, KPIs, and predictive modeling

Data Flow: Field to National



Bidirectional Communication

Data moves up for processing; configuration and commands flow down.

→ Upward

Detection events → transaction records → aggregated financials

→ Downward

Tariff tables, device firmware updates, VMS messaging

Detection Technology Comparison

Primary Classification

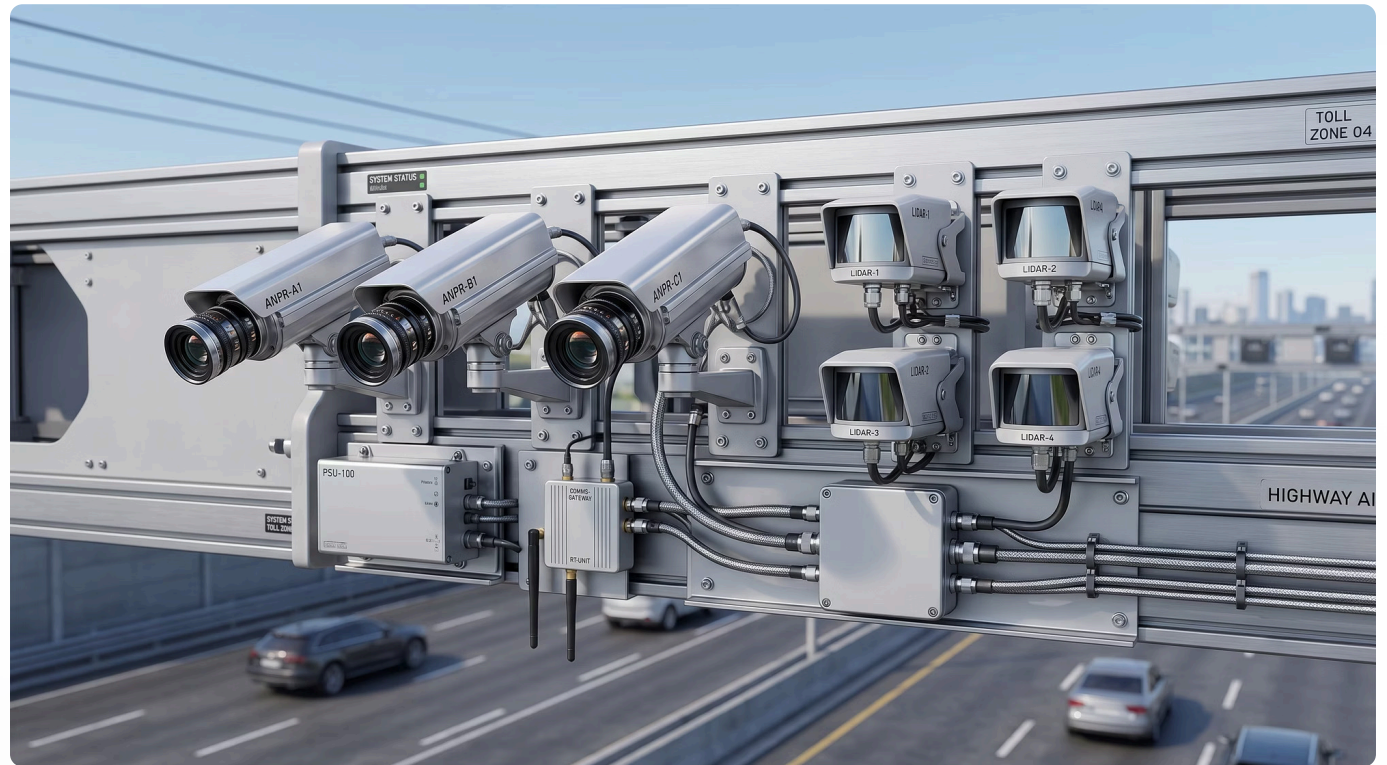
LiDAR + Radar — geometry and speed, lane-accurate

Identity Capture

ANPR + RFID — plate image and transponder, cross-validated

Enforcement Evidence

CCTV — timestamped imagery for dispute resolution



Regional vs. National Responsibilities

Regional Center

- Operational continuity
- Local incident response
- Driver-facing messaging (VMS)
- Lane-level transaction capture

National Center

- Interoperability & scheme clearing
- Revenue settlement across operators
- Network analytics & reporting
- Regulatory compliance data

Scalability Considerations



01

Edge Redundancy

Field devices operate independently if regional comms fail

02

Regional Failover

Hot-standby centers ensure no gap in transaction capture

03

National Resilience

Distributed clearing nodes protect settlement integrity

Architecture Summary

Field

Multi-sensor detection —
LiDAR, Radar, ANPR, RFID,
CCTV

Regional

Operations, incident
management, VMS control

National

Clearing, settlement, network analytics

