Next-Generation Supply Chain Visibility

5G-Powered WebRTC Solutions for Live Cargo Monitoring and Stakeholder Communication

Diwakar Reddy Peddinti

RTC Conference and Expo 2025,

7 October 2025

The Visibility Crisis

Blind Spots

Traditional RFID/GPS provides only periodic updates, creating critical gaps in shipment monitoring

Communication Delays

Limited real-time stakeholder interaction leads to delayed responses to cargo issues

Visual Verification Gap

Inability to verify cargo conditions visually during transit creates security vulnerabilities

Pain Points Across Stakeholders

1

Shippers

Rising spoilage, damage, and insurance claims from lack of real-time condition data.

2

Carriers

Blind spots and fragmented tracking due to disparate devices and networks.

3

Forwarders

Slow, error-prone manual updates cause operational delays and inefficiency.

4

Consignees

Inaccurate ETAs disrupt labor, dock utilization, and inventory planning.

Market Opportunity

$61.17B

IoT Logistics Market 2025

Projected to reach $119.86 billion by 2030

$30B

Cargo Theft

In stolen Cargo goods and pharmaceutical spoilage each year

43.3%

5G Network Slicing CAGR

Market growth rate through 2030

Market Opportunity

- **Leverage the rapid expansion** of connected logistics and high-value shipment markets to capture a greater share of this growing industry.
- **Unlock new revenue streams** through premium visibility solutions, including fully customizable and white-labeled customer portals.
- **Reduce operational risks and boost profitability** by minimizing spoilage, preventing chargebacks, and securing better insurance terms through enhanced shipment integrity.
- **Differentiate in the market and strengthen customer trust** with live, transparent, and shareable end-to-end visibility across the supply chain.

Technology Foundation

IoT Connectivity Technologies

- BLE 5.0 (Bluetooth Low Energy)
- RFID (Radio Frequency Identification)
- LoRaWAN (Long Range Wide Area Network)
- Multi-protocol gateways

5G Network Enablers

- Sub-10ms ultra-low latency
- Network slicing for QoS guarantee
- Massive IoT connectivity support
- Edge computing integration

WebRTC Capabilities

- Peer-to-peer communication without plugins
- Real-time audio, video, and data transfer
- Built-in DTLS-SRTP encryption
- Browser-native implementation

System Architecture

01

IoT-Enabled Smart Containers

Multi-sensor arrays with 5G cameras and edge processing units for local analytics

02

5G Network Infrastructure

Network slicing, edge computing nodes at logistics hubs, STUN/TURN servers

03

WebRTC Communication Layer

Direct P2P connections with adaptive bitrate for varying network conditions

04

Stakeholder Dashboards

Browser-based monitoring with real-time alerts and communication channels

Data Pipeline and Analytics

- Ingest: normalize device payloads (protobuf/JSON) with timestamps
- Storage: time-series + object store for media and audit logs
- Analytics: anomaly detection, condition breach prediction, ETA ML
- Actions: rule-based alerts, automated ticketing, SLA evidence trails

Security, Privacy, and Compliance

- Device identity: TPM/eSIM attestation; mutual TLS for control plane
- E2E encryption: DTLS/SRTP; rotating keys; short-lived tokens
- Role-based access: link-scoped, time-bounded, least privilege
- Compliance: chain-of-custody logs, GDPR/CCPA, data residency options

Key Innovations

Real-Time Visual Verification

Live HD video streaming from cargo compartments with on-demand inspection capabilities and compliance recording

Multi-Sensor Data Fusion

WebRTC data channels transmit temperature, humidity, shock, and GPS data alongside video streams

Instant Stakeholder Communication

Browser/App-based access with multi-party conferencing and screen sharing for crisis management

Real-World Applications

Pharmaceutical Cold Chain

Temperature-sensitive vaccine shipments with real-time monitoring and visual verification of storage conditions

High-Value Electronics

Shock monitoring, security breach detection, and live streaming during customs inspection

Perishable Food Logistics

Humidity control, quality verification at checkpoints, and stakeholder collaboration for route adjustments

Challenges & Solutions

Implementation Challenges

Upfront infrastructure setup costs and workforce training to troubleshoot the infrastructure.

Connectivity

Remote locations with poor 5G connections needs reliable wired connection as backup

Scalability

Distributed edge architecture for growing IoT device networks

Technical Challenges

Network Variability

Cargo moves through areas ranging from strong 5G zones to weak LTE, limited coverage, and satellite-only regions.

Network handoffs between carriers, countries, and technologies can cause data gaps or connection drops.

Standards Compliance

Adherence to industry protocols and regulations

Transforming Logistics

From reactive tracking to proactive cargo stewardship through real-time visual and data connectivity

1 **Today**

5G + WebRTC creates unprecedented supply chain visibility

2 **Tomorrow**

AI integration, digital twins, and blockchain for immutable records

3 **2030**

6G preparation for sub-millisecond latency and enhanced capabilities

> Industry collaboration for standards development and pilot programs will drive the next generation of supply chain transparency