Byzantine-Robust Platooning Under Credentialed Sequences

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What Byzantine-Robust Platooning Specifies

Each vehicle in a platoon independently reads the credentialed markers and broadcasts its own platooning state. The platooning state includes: position relative to the lead vehicle, lane occupancy, intent regarding upcoming maneuvers, and the vehicle's confidence in its own marker reading.

A Byzantine-robust consensus protocol over the broadcasts produces the platoon's coordinated operating state. Vehicles that misread markers (sensor failure, occluded markers, environmental conditions) or adversarially misreport (compromised vehicle, hostile actor) are detected and excluded from the consensus through their inconsistency with the credentialed marker reference.

Why Platoons Need Byzantine Robustness

Commercial autonomous trucking platoons are the highest-revenue near-term L4 deployment. The economic value depends on tight platooning (fuel savings, throughput) which in turn depends on coordination reliability. A platoon operating with even one misreporting vehicle faces structural collision risk if the misreporting goes undetected.

Byzantine robustness handles the structural concern. The credentialed marker sequence is the shared truth; vehicles whose state contradicts the credentialed truth are detected and excluded; the platoon continues to operate at high reliability even with imperfect participants.

How Consensus Composes With Marker Reading

Each vehicle's marker reading is itself a credentialed observation. The platoon's coordination protocol consumes credentialed marker readings from all participating vehicles plus the credentialed marker stream from the segment itself. Cross-vehicle consensus identifies which vehicle readings agree with the segment's credentialed truth.

Misreporting detection is structural. A vehicle that consistently reads markers differently from the credentialed segment truth is structurally suspect. The platoon's consensus excludes its contributions; the architecture supports the platoon continuing to operate while the misreporting vehicle is investigated or repaired.

What This Enables for Commercial Trucking

The autonomous-trucking industry's path to tight commercial platooning gains structural support that current ad-hoc coordination cannot provide. Byzantine-robust marker-track platooning supports the operating tempo and reliability that commercial deployment requires.

The architecture also supports adversarial-aware operation. A trucking corridor with adversarial actors attempting to disrupt platoons (cyber attack, GPS spoofing, marker tampering) faces detection through the consensus mechanism. The patent positions the primitive at the layer where commercial autonomous trucking will need adversarial-aware coordination.