

THE SUBSTRATE REPORT

THE NEW INDUSTRIAL STACK

Spectrum, AI, and the DePIN Counter-Movement

**MONTHLY
INTELLIGENCE**

Substrate-aware
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THE THESIS

The next layer of the internet is being built in orbit, embedded in our streets, and crowdsourced by the world.

EXECUTIVE SUMMARY

In April 2026, Amazon paid **\$11.6 billion** for Globalstar — not for the satellites, but for Band 53, the radio spectrum that lets a standard smartphone talk directly to orbit. Days earlier, Mavenir won the Mobile Satellite Users Association's **AI-by-Design NTN RAN** award for the cognitive radio access architecture that makes mass-scale direct-to-device satellite communication actually function. In the same months, decentralized physical infrastructure protocols — Geodnet, Helium, Hivemapper — crossed scale thresholds that make them credible counter-substrates to centralized hyperscaler infrastructure.

These are not three separate stories. They are three instances of the same architectural shift: networks are being assembled across diverse physical substrates, and a new operating layer is emerging to route between them. Volume 1 covers the **New Industrial Stack** from three angles — spectrum consolidation at the orbital layer, AI cognition at the radio access layer, and DePIN as the counter-substrate filling the gaps satellites physically cannot serve.

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STORY 1

The Spectrum War

On May 27–28, 2026, Amazon Inc., operating through Grapefruit Acquisition Sub II, LLC, completed its \$11.6 billion acquisition of Globalstar at \$90 per share — absorbing Apple's 400,000 Class B shares (a 20% equity stake) and assuming control of Band 53 of the Mobile Satellite Spectrum, 2483.5 to 2495 MHz. The headlines called it a satellite acquisition. They got it wrong.

Amazon does not need Globalstar's satellites. Project Kuiper has been launching its own constellation at scale since early 2025, with a stated target of 3,200+ active satellites by 2028. What Amazon paid for, and what most coverage missed, is the spectrum. Band 53 is the slice of radio frequency that lets a standard, unmodified smartphone — no special antenna, no add-on hardware — talk directly to a satellite in low Earth orbit. That capability, called direct-to-device or D2D, has been licensed and partially deployed by Apple under its Emergency SOS feature. Amazon now controls the underlying spectrum and inherits Apple as an anchor customer.

Band 53 = 2483.5–2495 MHz. The spectrum slice that talks to standard smartphones without special hardware. Amazon paid \$11.6B to control it.

In parallel, Amazon Kuiper Kenya Limited applied for a Tier 2 Network Facilities Provider license with the Communications Authority of Kenya (15M KES filing fee), positioning ground gateways across 47 Kenyan counties to serve as the terrestrial backhaul layer for the orbital network. A similar landing permit was granted in Nigeria in January. Three concurrent moves: orbital spectrum, ground infrastructure, regulatory presence in high-growth emerging markets.

Read narrowly, this is satellite M&A. Read in context — alongside Mavenir's AI-by-Design award the same month, alongside the consolidation of L-band and S-band spectrum across multiple hyperscalers — it is vertical integration across the radio access layer of the internet itself. The Globalstar acquisition is one move in a larger consolidation of substrate at the physical layer.

→ [Listen: The Giga & Byte Report — Episode 1, The Spectrum War](#)

STORY 2

AI at 17,000 MPH

A satellite in low Earth orbit travels at approximately 17,000 miles per hour. A smartphone on the ground travels at zero. Maintaining a stable radio connection between the two requires compensating for the Doppler effect in real time as the satellite races overhead, calculating timing advances to prevent data frames from colliding mid-transit, and dynamically steering phased-array antennas to maintain a beam lock as the orbital position changes second-by-second. None of this is solvable with the static optimization logic that runs traditional terrestrial cell sites.

On April 10, 2026, Mavenir received the Mobile Satellite Users Association's AI-by-Design NTN RAN award for the cognitive radio access network architecture that addresses these problems. Mavenir's framing, articulated at SATELLITE 2026 in Washington in March, is that artificial intelligence cannot be bolted on as a software afterthought — it must be embedded directly in the radio access network architecture, managing real-time resource slicing, frequency correction, and interference mitigation at the cognitive level. This is what makes mass-scale D2D commercially viable rather than an emergency-fallback service.

AI-by-Design is the cognitive layer that makes orbital substrate functional. Substrate-aware operates one rung above it — choosing when to use orbital, terrestrial, or DePIN routing.

The AI-by-Design framing is now spreading across the industry. T-Mobile and Ericsson began testing AI-RAN on live 5G Advanced networks in May. The AI-RAN Alliance, founded in February 2024, has grown to over 75 members including NVIDIA, whose Aerial Research Cloud is becoming the de facto compute foundation for cognitive RAN research. The 3GPP Release 19 specifications are incorporating AI-native primitives at the network layer.

AI-by-Design is the cognitive layer that makes the orbital substrate functional. Substrate-aware networks operate one rung above it — they decide *when* to use the AI-cognitive orbital substrate, when to use terrestrial cellular, when to route through decentralized infrastructure. AI-by-Design is the technology Mavenir is selling. Substrate-aware is the operating framework that consumes it.

→ [Listen: The Giga & Byte Report — Episode 2, AI at 17,000 MPH](#)

STORY 3

The Hyperscaler Bypass

Amazon and SpaceX are spending tens of billions of dollars on satellite constellations. The architectural ceiling of that bet is roughly **1,000,000 satellites** — the constellation size required to match the capacity density of terrestrial low-band cellular carriers (2×20 MHz). Below that ceiling, satellites cannot serve dense high-bandwidth use cases. Above it, the constellation does not commercially exist. That is the structural limit of the orbital substrate.

Decentralized physical infrastructure networks — DePIN — operate below the satellite ceiling, where bandwidth density and hyper-local granularity matter. Geodnet operates **9,500 RTK GPS nodes across 124 countries**. Helium runs **356,000 IoT hotspots** and 19,000 5G nodes. Hivemapper has mapped **341 million kilometers** of road via community-deployed \$549 dashcams. These are not satellite competitors. They serve the bandwidth-dense, hyper-local layer that orbital infrastructure physically cannot reach.

→ [Listen: The Giga & Byte Report — Episode 3, The Hyperscaler Bypass](#)

THE SUBSTRATE-AWARE VIEW

A **substrate-aware network** is one that knows which substrate it is operating on — orbital satellite, terrestrial cellular, DePIN mesh, fiber backhaul, on-chain coordination — and routes intelligently among them in real time, without the application layer noticing. The three stories in Volume 1 are instances of the same architectural shift.

Amazon's spectrum consolidation provides the orbital substrate. Mavenir's AI-by-Design provides the cognitive layer that makes the orbital substrate functional. DePIN protocols provide the last-mile, hyper-local substrate that orbital infrastructure cannot reach. None is complete on its own. None is replaceable by another. The valuable architectural position is one rung above all of them.

The framework is *falsifiable*. It would be wrong if one substrate consolidates so completely that cross-substrate routing becomes unnecessary, if technical handoffs between substrates fail to commercialize at scale, or if regulatory complexity blocks cross-substrate routing in major markets. We do not believe any of these are likely in the next twenty-four months.

WHAT TO WATCH — NEXT 30 DAYS

- 01 Amazon Tier 2 NFP approvals** in two or more African markets. Signals the ground gateway war moving from regulatory filings to deployment.
- 02 SpaceX D2D commercial launch with T-Mobile.** Second hyperscaler entering the consumer D2D market. Critical pricing and capability benchmarks.
- 03 NVIDIA Aerial Research Cloud Q3 release.** Sets the AI-RAN compute baseline that downstream cognitive network implementations will build on.
- 04 AT&T / AST SpaceMobile D2D deployment progress.** Third entrant in the D2D consumer market — confirms or disconfirms the three-way structure.
- 05 Geodnet token economics announcement.** Leading DePIN protocol may signal incentive layer maturity — relevant precedent for the broader DePIN sector.

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9. Amazon Kuiper Kenya Limited — CAK Tier 2 NFP filing
10. Geodnet network statistics — protocol documentation
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About The Substrate Report. Published monthly by T.A. Resendez Inc. Each Volume covers one industry thesis through podcast, written brief, and (starting Volume 3 in August 2026) a paid Intelligence Report tier. The substrate-aware framework is our operating lens — a network smart enough to know which substrate to use for which job.

Volume 1 — The New Industrial Stack — drops June 8–10, 2026. **Volume 2 ships July 2026: The Cognitive RAN.**

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