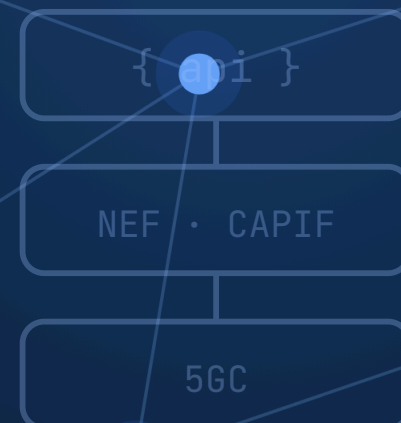




● TECHNICAL WHITEPAPER

Network APIs: The Plumbing, the Promise, and the P&L

How NEF, CAPIF and CAMARA turned the 5G core into something developers can call — and an honest ledger of the forecasts, the write-downs, the 94%-China revenue base, and why the most 5G-shaped API is the one not selling yet.

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OPEN GATEWAY

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Abstract—The 5G core has known how to take orders from outsiders since Release 15. What it lacked was anything a developer would willingly call — and anyone to bill. This paper walks the three layers that grew to fix that, each existing because the one below it was not sellable: the 3GPP exposure plumbing (NEF, CAPIF, the TS 29.522 northbound contract, and Rel-18's RNAA consent), CAMARA's developer-shaped intent APIs (60 released, 10 stable, as of the Fall25 meta-release), and the commercial layer — GSMA Open Gateway at 86 operator groups and 300-plus self-reported commercial API instances, with aggregators like Aduna delivering one contract for all three US carriers. Then the money, printed the only honest way: four forecasts that span more than an order of magnitude because they measure different things; the fact that 94% of 2024 revenue was China; Ericsson's roughly \$4B Vonage tuition fee; and the consistent finding that identity-and-fraud APIs pay today while Quality on Demand — the API that actually exercises 5G QoS machinery — is parked beyond 2030 by the very analysts tracking it.

1. Why Exposure Exists: The 3GPP Plumbing

Strip away the conference branding and a network API is a fifteen-year-old engineering idea finally wearing a price tag: let an outside application ask the network for something — a quality boost, a location check, a fact about a SIM — through a controlled, billable interface. The 5G core was built for this. The **Network Exposure Function (NEF)** is the designated front door, specified in TS 23.501 §6.2.5: it exposes capabilities and events to third-party application functions, translates external identifiers into internal ones (an AF-Service-Identifier becomes a DNN and S-NSSAI), and masks network- and user-sensitive information according to operator policy [1]. The actual REST contract an application sees — the OpenAPI definitions for things like *AsSessionWithQoS*, which requests a QoS treatment without ever naming a 5QI — is stage 3, TS 29.522 [3].

Around the front door stands the doorman: **CAPIF**, the Common API Framework (TS 23.222, in the architecture since Rel-15), which handles what every API program needs and no one demos — authentication, authorization, discovery, publication, logging and charging — through its API-invoker / core-function / exposing-function triangle, with dedicated reference points for invokers outside the operator's trust domain [2]. And Rel-18 closed the loop that mattered most for regulators: **RNAA**, resource-owner-aware northbound API access, brings OAuth-style consent into CAPIF so the *subscriber* authorizes an API acting on their line. Before Rel-18, when a game server boosted QoS on your connection or read your device's location, you had no visibility and no veto [4]. Fig. 1 stacks the whole apparatus.

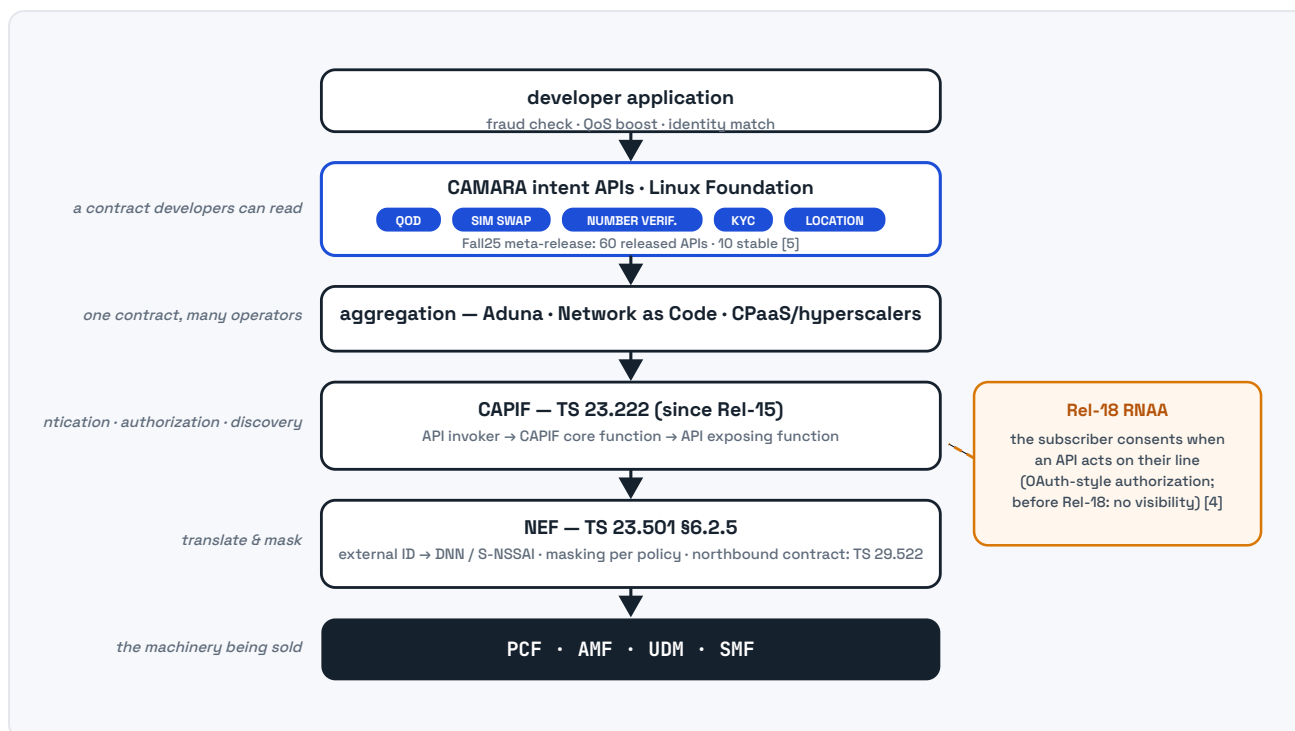


Fig. 1. The exposure stack, bottom to top: the 5GC machinery, the NEF that translates and masks it, the CAPIF framework that governs access to it, the aggregators that sell it once instead of eighty-six times, and the CAMARA contract a developer actually reads. Rel-18 RNAA adds the subscriber's consent at the framework layer [1]–[5].

Here is the uncomfortable fact the rest of this paper hangs on: this plumbing worked, and almost nobody came. TS 29.522 is a machine-readable contract written for telecom insiders; no fintech developer was ever going to discover a 5QI. Each layer above the plumbing exists because the layer below it was not sellable.

2. From Plumbing to Product: CAMARA

CAMARA is the translation layer. Initiated in 2021 and formally launched in February 2022 as a Linux Foundation open-source project with 22 partners (moving to a funded model with roughly 250 organizations in September 2023), it standardizes *intent* APIs: OpenAPI definitions, maintained in public on GitHub, that operators implement on top of their 3GPP exposure layer [5]. The design philosophy is subtraction. A CAMARA **Quality on Demand** call asks for an outcome ("stable low latency for this session") and never mentions 5QI or S-NSSAI. **SIM Swap** answers one question a bank actually has — has this number's SIM changed recently? — without exposing a byte of UDM internals.

The catalog is now substantial. The Fall25 meta-release (October 2025) counts **60 released APIs — 10 of them stable** and implementation-ready, including SIM Swap, Number Verification, Location Verification, Quality on Demand with QoS Profiles, one-time-password SMS, device roaming and reachability status, and Simple Edge Discovery — from a community of 1,300-plus contributors across 476 organizations [5]. One nuance worth noticing because it recurs across this market: spec status and market status are different clocks. **KYC Match** — matching a customer-supplied name, address and birthdate against the operator's verified records for anti-fraud compliance — still sits in a CAMARA *incubating* repository, yet it is commercially offered today, for instance on Telefónica's Open Gateway storefront [6], [7]. Where there is fraud to stop, the market does not wait for the "stable" label.

3. The Commercial Layer: Open Gateway and the Aggregators

GSMA Open Gateway is the go-to-market wrapper: a shared operator commitment to expose the same CAMARA APIs the same way. It launched at MWC Barcelona on 27 February 2023 with 21 mobile network operators and eight "universal" APIs, AWS and Microsoft Azure supporting at launch [8]. A year in: 47 operator groups, 239 networks, 94 commercial API instances across 21 markets [9]. By March 2026: 86 operator groups, 300-plus networks, 80% of global mobile connections signed, with 300-plus commercial instances of 20 different CAMARA APIs across 65 markets and 60-plus channel partners — and new names still joining (Rakuten Mobile signed the MoU on 5 March 2026) [10], [11]. Read those numbers for what they are: GSMA's own supply-side footprint metrics. An MoU signature is not a commercial launch, a launch is not revenue, and an "instance" counts an operator-API pair, not API calls. Fig. 2 plots the curve with that caveat attached.

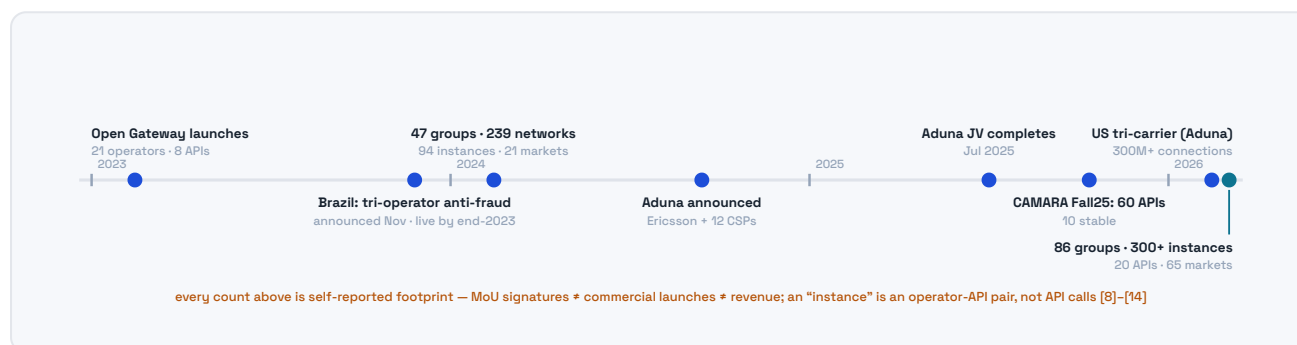


Fig. 2. The supply side compounds, 2023–2026: from 21 operators and 8 API definitions to 86 groups and 300+ commercial operator-API instances — every figure self-reported by GSMA, Aduna or CAMARA [5], [8]–[14].

The newest layer is **aggregation**, solving the problem Open Gateway named but couldn't finish: a developer wants one contract, not eighty-six. **Aduna** — announced September 2024, completed July 2025 as a 50:50 joint venture between Ericsson and twelve carrier groups (AT&T, Deutsche Telekom, Orange, Reliance Jio, Telefónica, T-Mobile, Verizon, Vodafone among them) — reached a genuine milestone in February 2026: agreements covering all three major US carriers, giving developers CAMARA-compliant access to 300M-plus US connections through one platform (company-reported) [12]–[14]. **Nokia's Network as Code** counts 75-plus partners and, notably, a Google Cloud collaboration exposing network APIs to AI agents over MCP [16]. The backstory explains the structure: Ericsson paid **\$6.2B for Vonage** in 2022, then wrote down SEK 32B (announced October 2023, roughly \$2.9–3B at press conversion) and another SEK 11.4B (~\$1.1B) in July 2024, mainly relating to Vonage — a tuition fee approaching \$4B — before mutualizing the strategy into Aduna, which trade reporting describes as structured to cover costs rather than generate profit [15], [24]. The bet moved from CPaaS margins to operator API volume.

4. The Money Question: Four Forecasts, One Ledger

Ask what this market is worth and you will collect answers spanning more than an order of magnitude. They are not contradicting each other so much as answering different questions — which is why Table 1 prints each with its scope and its health warning, and why this section refuses to average anything.

TABLE 1 • The forecast ledger — five numbers that do not measure the same thing [15], [17]–[20], [24]

Source	The number	What it measures	Read it with
McKinsey, Feb 2024	~\$100–300B + \$10–30B	“unlock” over 5–7 yrs: mostly enabled connectivity/edge revenue, plus direct API fees — scenario-style	originally published as \$300–500B, revised down mid-2024 without notice; amplified by GSMA; primary page unreachable — reported figures
STL Partners, Aug 2025	\$31.5B by 2030	total network-API revenue; identity ~\$3B (2025) → \$12B (2030); network-performance APIs \$5.3B by 2030	cut ~8.5% from its 2024 forecast after mapping actual per-market rollout data
Analysys Mason, Jun 2025	\$550M ('24) → \$7.6B ('30)	CAMARA-based API spend — 0.6% of mobile service revenue in 2030	94% of 2024 revenue was China (\$521M); places the QoD revenue wave after 2030
Juniper Research, Aug 2025	\$284M ('25) → >\$8B ('30)	network-API revenue, led by SIM Swap, Number Verification, KYC	baseline does not reconcile with Analysys Mason's — different scope; never average them
Ericsson leadership, Feb 2026	“tiny”	qualitative: revenues real, starting to ramp	the only operator-side public characterization; no audited API revenue exists anywhere (attributed via trade press)

Three readings matter. First, **the headline number has a history**: McKinsey's February 2024 article originally said \$300–500B and was quietly revised to “around \$100–300B” within months — and either way the bulk is *enabled* connectivity and edge revenue over five-to-seven years, not API fees; the direct-API estimate is \$10–30B [17]. Second, **the baselines disagree**: Analysys Mason measures \$550M of CAMARA-based spend in 2024 while Juniper's 2025 baseline is \$284M — a scope difference (what counts as a network API, and how China counts) that was never publicly reconciled, so quoting them side-by-side without that caveat is malpractice [19], [20]. Third, and least advertised: **94% of 2024 network-API revenue was China** — \$521M of authentication and number verification at scale — projected to dilute to 37% by 2030 [19]. The “global API economy,” measured in revenue rather than memoranda, is currently a China number-verification story; GSMA's own showcase notes China Mobile uses number verification to lift advertising conversion, not to fight fraud [10], [19]. Against all of this stands the one operator-side public characterization of actual revenue, from Ericsson leadership in February 2026: real, ramping, and “tiny” [24]. No operator or aggregator has published audited network-API revenue. Anywhere.

5. What Is Actually Selling

The pattern in every deployment list is the same: **identity and fraud pay the bills**. The pioneer market is Brazil — Claro, TIM and Vivo announced Number Verify, SIM Swap and Device Location APIs on 28 November 2023, commercially available by end-2023, aimed at mobile commerce and financial institutions and designed against LGPD [21], [22]; in 2026 Aduna signed all three to accelerate the same market [23]. The United States got its one-contract moment in February 2026 via Aduna's tri-carrier coverage [14]. GSMA's 2026 showcase points to UK banks running SIM-swap checks, One New Zealand's network-authentication APIs, and Orange's manufacturing work with Shabodi — named examples we have not independently audited [10]. STL's forecast says the quiet

part in numbers: identity APIs grow from just under \$3B (2025) to \$12B (2030) — the majority of all projected revenue [18].

And then there is the irony at the centre of this subject. **Quality on Demand — the API that actually exercises 5G's QoS machinery**, the one that touches the PCF and justifies the 5QI table — is the one not selling. Analysys Mason places the QoD revenue wave *after 2030*; even STL, the most bullish house in the ledger, pencils network-performance APIs at a modest \$5.3B by 2030 against identity's \$12B [18], [19]. The reasons are unglamorous: a SIM-swap check works on any network generation, needs no QoS plumbing, and removes a fraud cost a bank can already quantify. A QoD boost needs deployed policy infrastructure, cross-operator behavioral consistency, and — hardest of all — application developers who have priced what a guaranteed network treatment is worth to them. The most 5G-shaped product in telecom's API store is the one still waiting for its customer.

6. Verdict 2026: Supply Is Ahead of Demand, by Design

Where does that leave a planner in mid-2026? The supply side is genuinely built: the 3GPP plumbing is mature and consent-aware, CAMARA's contract discipline is real open-source governance rather than brochure-ware, footprint compounds every quarter, and aggregation has collapsed the integration problem to one contract in the largest markets. The demand side is one proven product family (identity/fraud), one giant customer geography (China), and a revenue line the supply side's own architect calls tiny [24]. Telecom has launched operator API programs before and watched them stall; the honest difference this time is structural — an open-source spec community and aggregators that remove per-operator integration — and the honest similarity is that demand beyond fraud remains a forecast, not a fact.

The wildcard is worth one labeled-speculative sentence: if AI agents become first-class API consumers — the direction Nokia and Google Cloud's MCP work points at — demand stops scaling with human developer adoption and starts scaling with machine traffic, which would redraw every curve in Table 1 [16]. For engineers, the guidance is plainer. If you operate a network: ship the identity family first — it sells now — and wire RNAA consent in from day one, because regulators will eventually ask the question Rel-18 answered [4]. Implement QoD profiles as option value; do not build the business case on them yet. And when anyone shows you a market forecast, ask Table 1's three questions: what does it measure, what is the China share, and does the baseline reconcile with anyone else's. The network has learned to take orders. What 2026 cannot yet tell you is how many customers walk in — only that the first ones came for the fraud desk, not the fast lane.

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