CAMARA

THE TELCO GLOBAL API ALLIANCE

Presentation

05.06.2025

Content of the CAMARA presentation

CAMARA
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- **#3** CAMARA Mission
- **#4-#7** CAMARA Motivation – Key problems we try to solve
- **#8-#14** CAMARA Scope, Collaboration with Open Gateway and TM Forum, API Distribution Options
- **#15** What is different now in comparison to former API exposure trials?
- **#16-#18** History, Logos & Current Figures – Where we started and where we are now
- **#19-#26** Current Meta Release, CAMARA APIs, Showcases, Public Launch Status
- **#27-#29** 5G network capabilities, Potential Business Use Cases
- **#30-#33** Benefit for developers to use CAMARA APIs & Getting Started
- **#34-#38** Benefit for developers to work in CAMARA & Joining CAMARA as Developer
- **#39-#41** Benefit for operators to implement CAMARA APIs in their networks & Getting Started
- **#42-#44** Benefit for operators to work in CAMARA & Getting Started
- **#45-#46** Where are we going next, Contacts

APIs enabling seamless access to Telco network capabilities

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Telco network capabilities exposed through APIs provide a large benefit for customers. By simplifying telco network complexity with APIs and making the APIs available across telco networks and countries, CAMARA enables easy and seamless access.

CAMARA Mission

What is the CAMARA Project?
Key problems we try to solve

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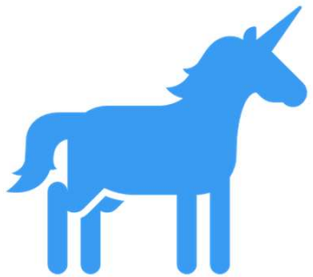
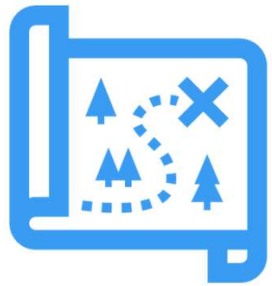


Scale

Developers dream of being the next unicorn... If apps, products, or services are built on our APIs they want them in all relevant markets and networks globally.

Consistency

Multi-nationals want consistency across all markets they operate in... they do not want APIs that only work in a single network in a single country. They do not want to try and build for the differences of each network.



Simplicity

Telco networks are complex, and every network is different.... Developers want simple, intent-based APIs.

Accessibility

We go to the developers where they are so the project is open sourced in the Linux Foundation. Allowing API users to work directly with CSPs creating the service.

Demand Driven

We develop the APIs and design it in the way our customers need it. The demand is collected from organizations like GSMA OPAG but also from customers directly.

Key problems we try to solve
Consistency Benefit

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Availability across telco networks and countries is necessary:

- To ensure seamless customer experience
- To accelerate technology development and commercial adoption (minimize implementation effort)
- To accelerate education and promotion
- To support application portability

Key problems we try to solve
Simplicity Benefit

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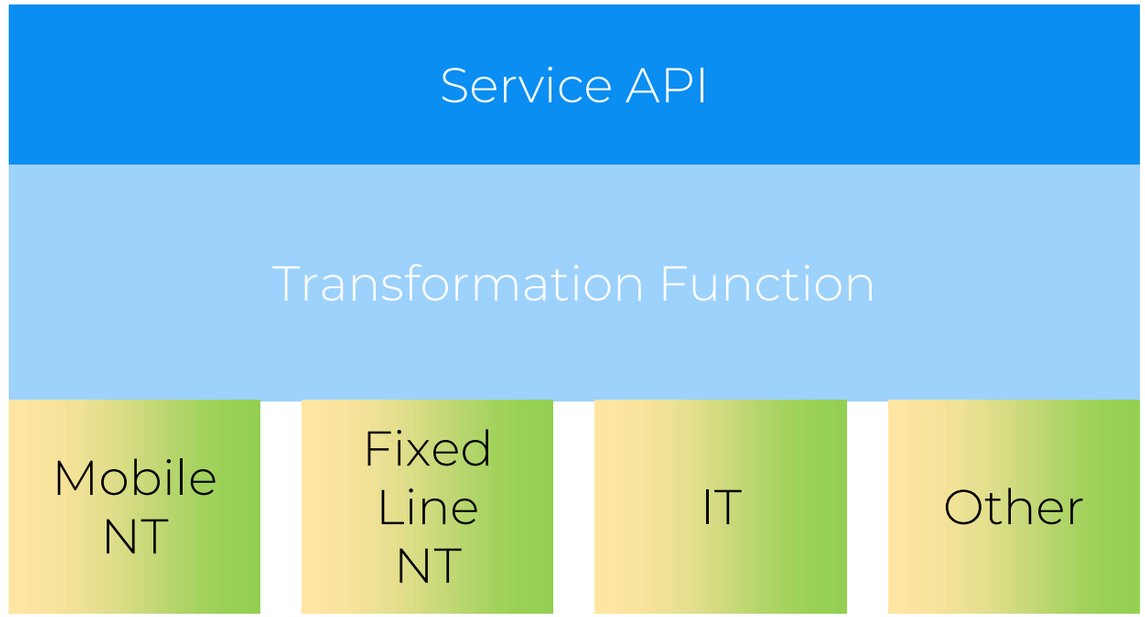
Abstraction by transformation from network capabilities to Service APIs is necessary:

- To simplify telco complexity making APIs easy to consume for customers with no telco expertise (user-friendly APIs)
- To satisfy data privacy and regulatory requirements
- To facilitate application to network integration



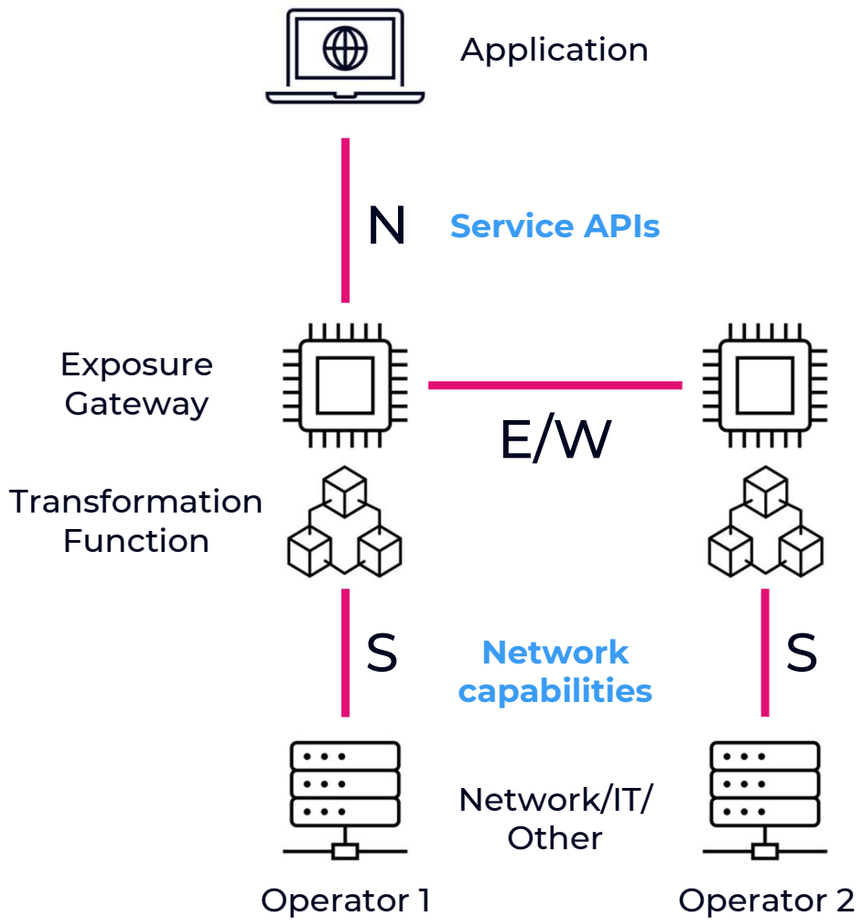
CAMARA
Open Source

CAMARA is an open source project within Linux Foundation to define, develop and test the APIs. CAMARA works in close collaboration with the GSMA Operator Platform Group to align API requirements and publish API definitions. Harmonization of APIs is achieved through fast and agile created working code with developer-friendly documentation. API definitions and reference implementations are free to use (Apache2.0 license).

CAMARA Scope

From functional perspective the scope is limited to **telco APIs**, that means APIs in the domain of telco mobile networks, telco fixed line networks, telco edge cloud, etc. or supporting these.

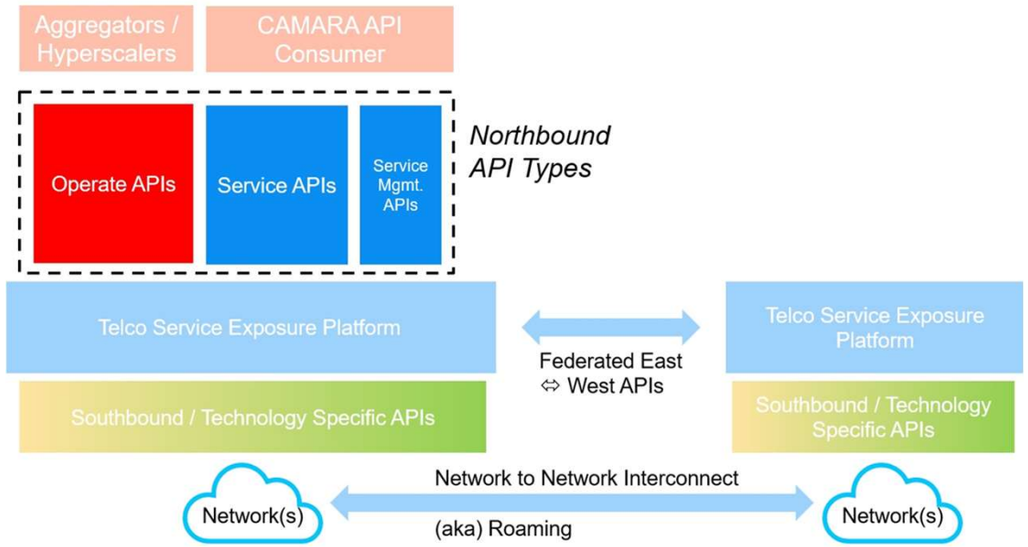
Thereby the focus is on the **northbound interface** (between telco operator and aggregator or capability consumer). East-/westbound interface APIs are out of scope for CAMARA.



CAMARA Scope

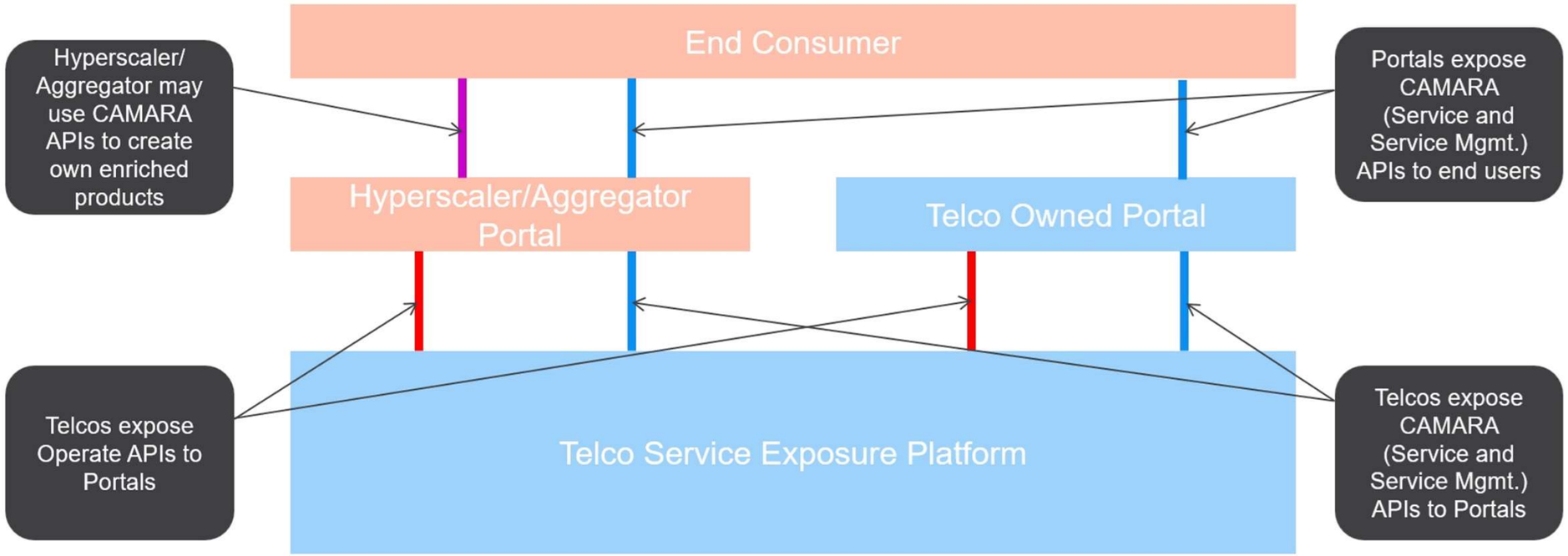
We differentiate between 3 types of Northbound APIs:

- **Service APIs:** APIs intended for end consumers and integrated by developers to invoke a certain telco capability.
- **Service Management APIs:** APIs intended for end consumers to manage or get data about offered Service APIs in application runtime, e.g., check service availability or performance information.
- **Operate APIs:** Operational and maintenance APIs provided by a telco to channel partners for the purpose of service fulfillment and assurance to their [channel partner] customers. This may include service provisioning for a mobile user, technical API performance monitoring, fault ticketing, information exchange such as product catalog, pricing, settlement, etc.



Service APIs and Service Management APIs are in scope of CAMARA. Operate APIs are out of scope of CAMARA (these are already covered by other SDOs = Standards Development Organizations like TM Forum).

CAMARA – Scope / Collaboration with Open Gateway and TM Forum



Hyperscalers and aggregators have the possibility to create own enriched products based on the CAMARA APIs and expose that in addition to the CAMARA APIs.

CAMARA – Scope / Collaboration with Open Gateway and TM Forum

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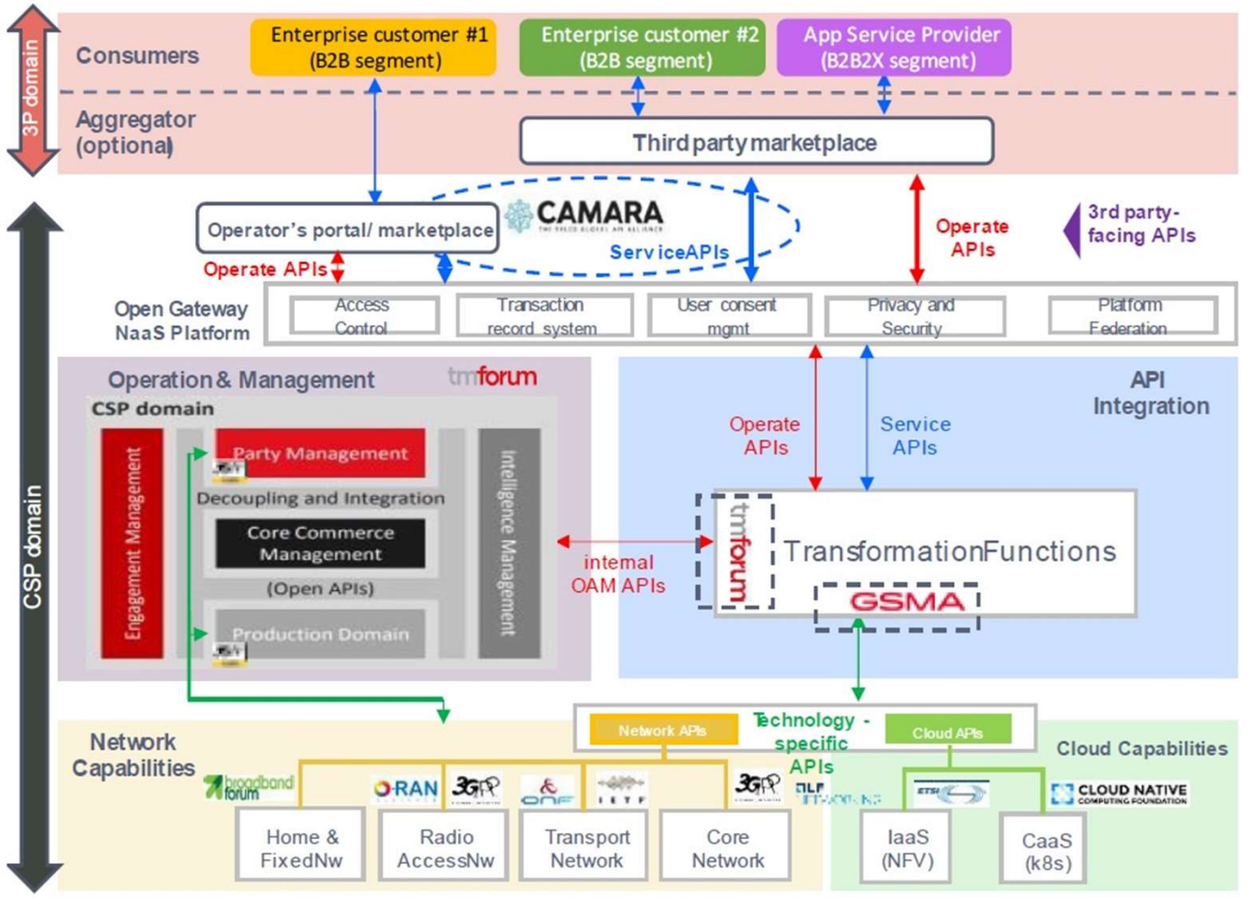

3rd Party-facing APIs

Service APIs
App-centric, developer-oriented
Apache2.0 lic, user -friendly , easy-to-use
Example: QoD, verify location, device status, SimSwap,….
Includes some management functionality used from the apps (in-app OAM APIs)
Hosted by CAMARA
Contributed by OpenGateway partners , directly or supported by bodies like
GSMA 5GFF tmforum bridge CableLabs

Operate APIs
Management oriented
Easy-to-implement , easy-to-use, simple
Example: register, account, monitor, issue mgmt, order/purchase, pay…
Provides an easy integration of the NaaS Platform with marketplaces /portals
Contributed by OpenGateway partners, hosted by tmforum

Technology -specific APIs
Technical capability oriented, standard, (FRAND) deterministic
Example: policysetting parameter setting information check..
Contributed by specific domain SDOs

CAMARA project defines CAMARA APIs.

TMForum develops the Operate APIs.

Several SDOs cover the different technology domains that provide the telco capabilities.

More details can be found in the whitepaper "The Ecosystem for Open Gateway NaaS API Development" (jointly published by GSMA, CAMARA, Linux Foundation and TMForum) available here.

CAMARA – Scope / Collaboration with Open Gateway and TM Forum

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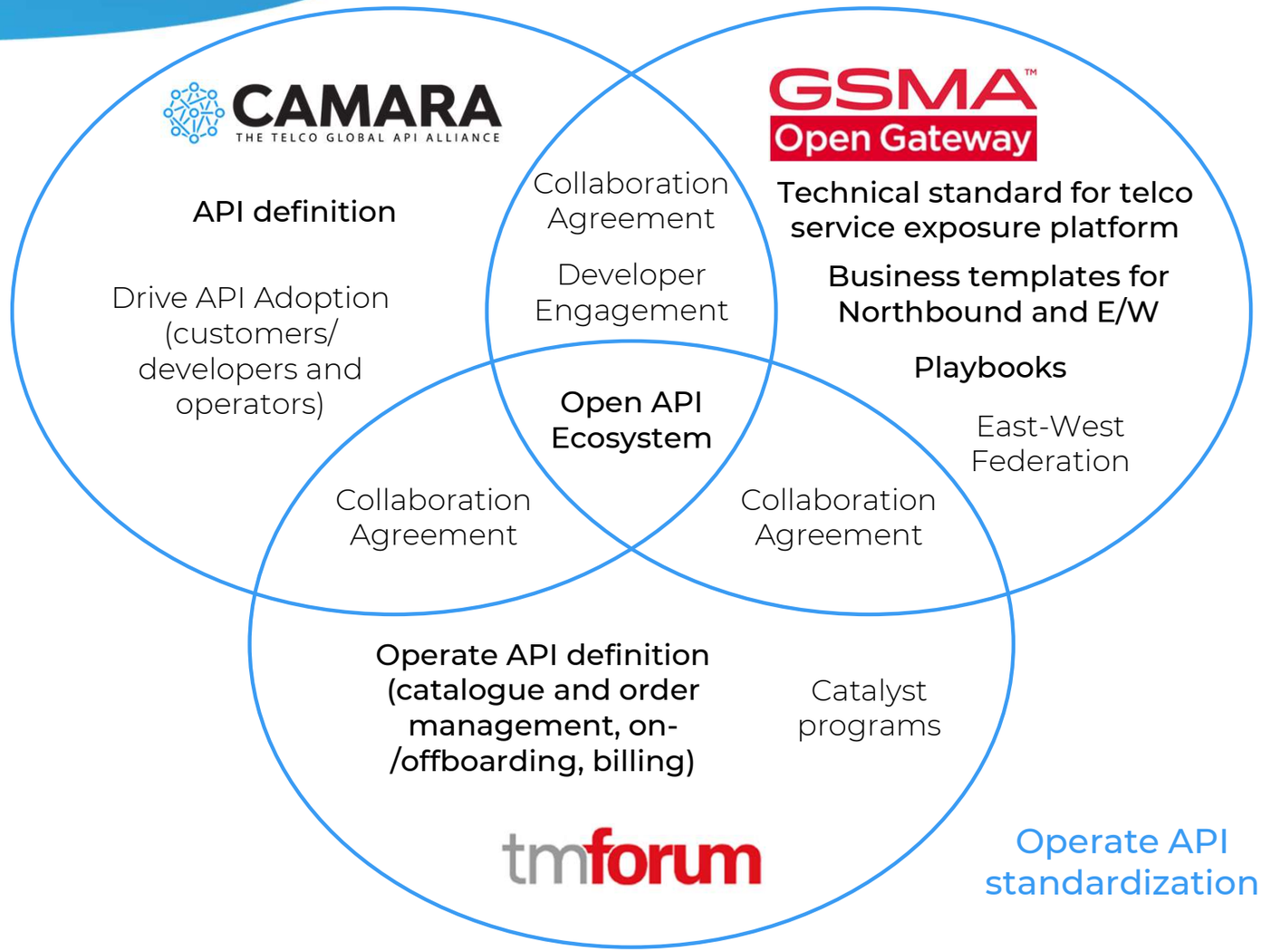
Service API "standardization"



Standardization of telco service exposure platform

Operate API standardization

CAMARA Scope

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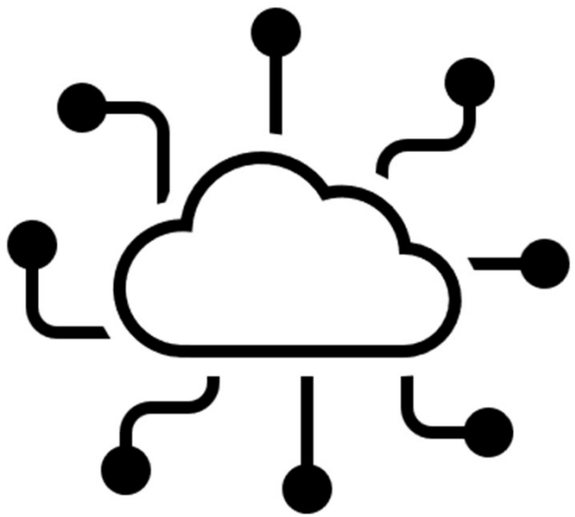
The scope of the CAMARA Project is:

- **Collect API requirements** from GSMA Operator Platform Group and other sources
- **Define Service APIs and Service Management APIs**
- Create test plans / cases / tools from an API consumer perspective
- **Develop and test Service APIs and Service Management APIs**
- Create developer friendly **documentation**



The following deliverables are provided by the CAMARA Project:

- **Service API and Service Management API definitions and documentation**
- Optionally Service API and Service Management API code and
- Test plans, cases and tools for the APIs all contained in deployment packages.

Project resources can be found in the **GitHub repository**: https://github.com/camaraproject.

CAMARA API Distribution Options

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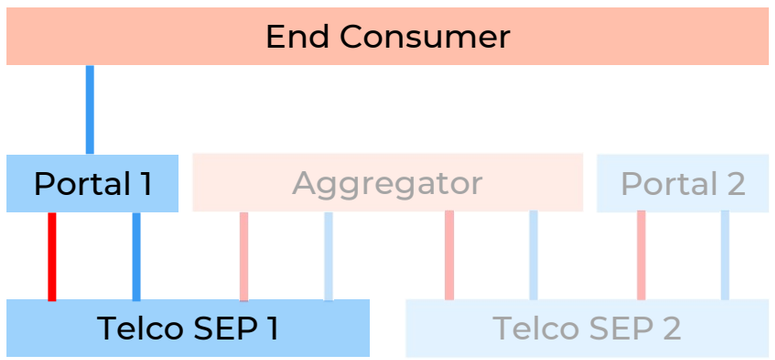
Single-Operator Relationship

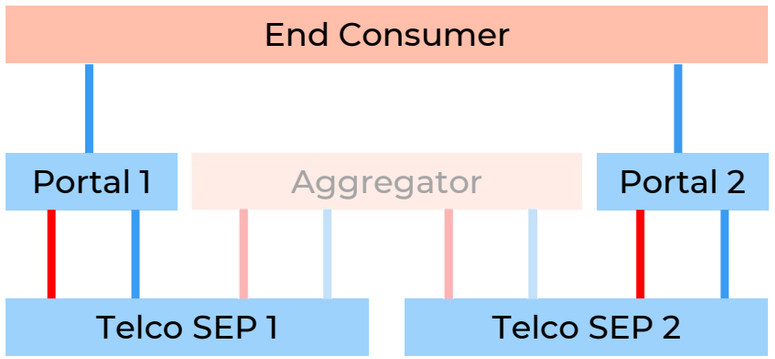


Blue lines = CAMARA APIs

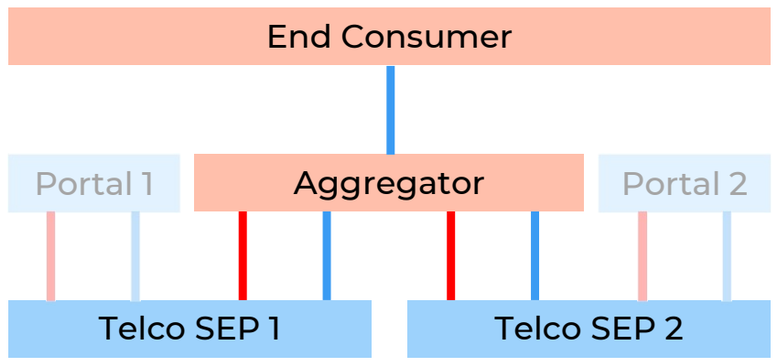
Red lines = Operate APIs

SEP= Service Exposure Platform

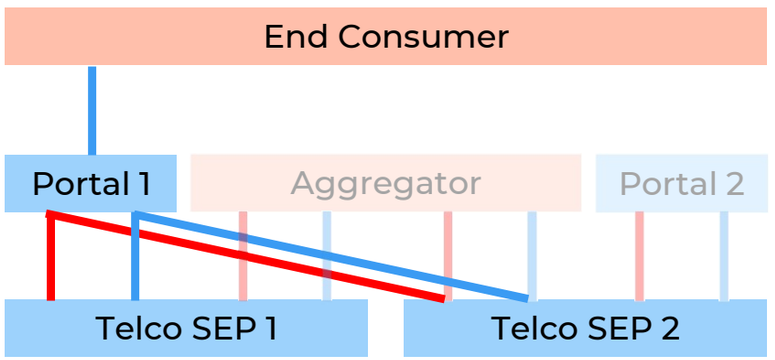
Multi-Operator Relationship



Operator Aggregation



Single-Operator “API Roaming”



What is different now in comparison to former API exposure trials?

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- **Simplicity** – Telco complexity is hidden behind simple, easy to use APIs
- **Demand driven** - Listening to API consumer's voice and demand
- **Availability** – Open APIs with great support of many operators on many platforms
- **Alignment** - With standardization bodies like TM Forum, GSMA or ETSI-MEC
- **Sustainability** – We have the CEOs behind (e.g. Open Gateway MoU, API Venture)
- **Telco maturity** – Telcos are now more digital and cloud oriented
- **Privacy** – Well defined

CAMARA
Where we started...

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Launched at MWC Barcelona 2022

22 Launch Partners

Supported by GSMA and Linux Foundation

Simple idea to “standardize” developer facing APIs

CAMARA
… and where we are now

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- 165 Named Partners
- 467 companies participating in CAMARA
- 9 API Sub Projects
  29 Sandbox Projects
  61 APIs
  5 Working Groups
- 1292 people joined CAMARA
- Development ”home” for GSMA Open Gateway

CAMARA Logos

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Release Management Motivation and Benefits

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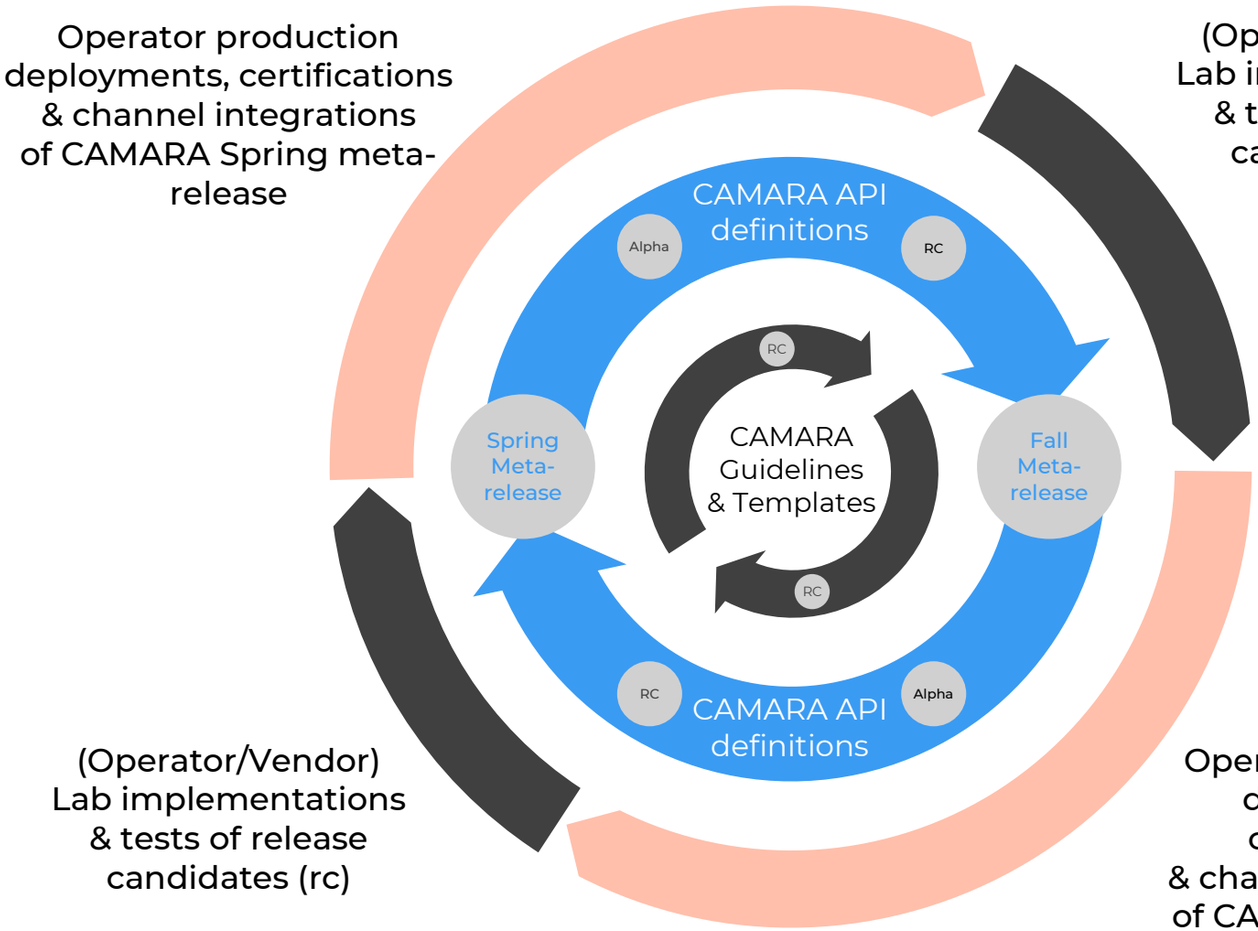
- A **CAMARA meta-release** combines a set of CAMARA API versions into a **consistent** release.
- There are **two meta-releases per year** (in spring and fall).
  - API providers (e.g. Network operators, Channel Partners) can plan their implementations and deployments in production.
  - API consumers can plan the integration in their platform and applications.
- All API versions in a meta-release **fulfill defined quality criteria** and are **compliant to the CAMARA guidelines** from CAMARA Commonalities and Identity and Consent Management of that meta-release.
- **CAMARA meta-releases** ensure the
  - Availability of consistent API definitions (by use of guidelines, templates, and linting),
  - Quality of API definitions (by use of checklists, test definitions, and release management),
  - Stability of API definitions (clear criteria for stable versus initial API versions) and
  - Reliability of schedule and deliverables (with defined milestones and release candidates).
- **CAMARA meta-releases** provide the foundation for API version management in production.

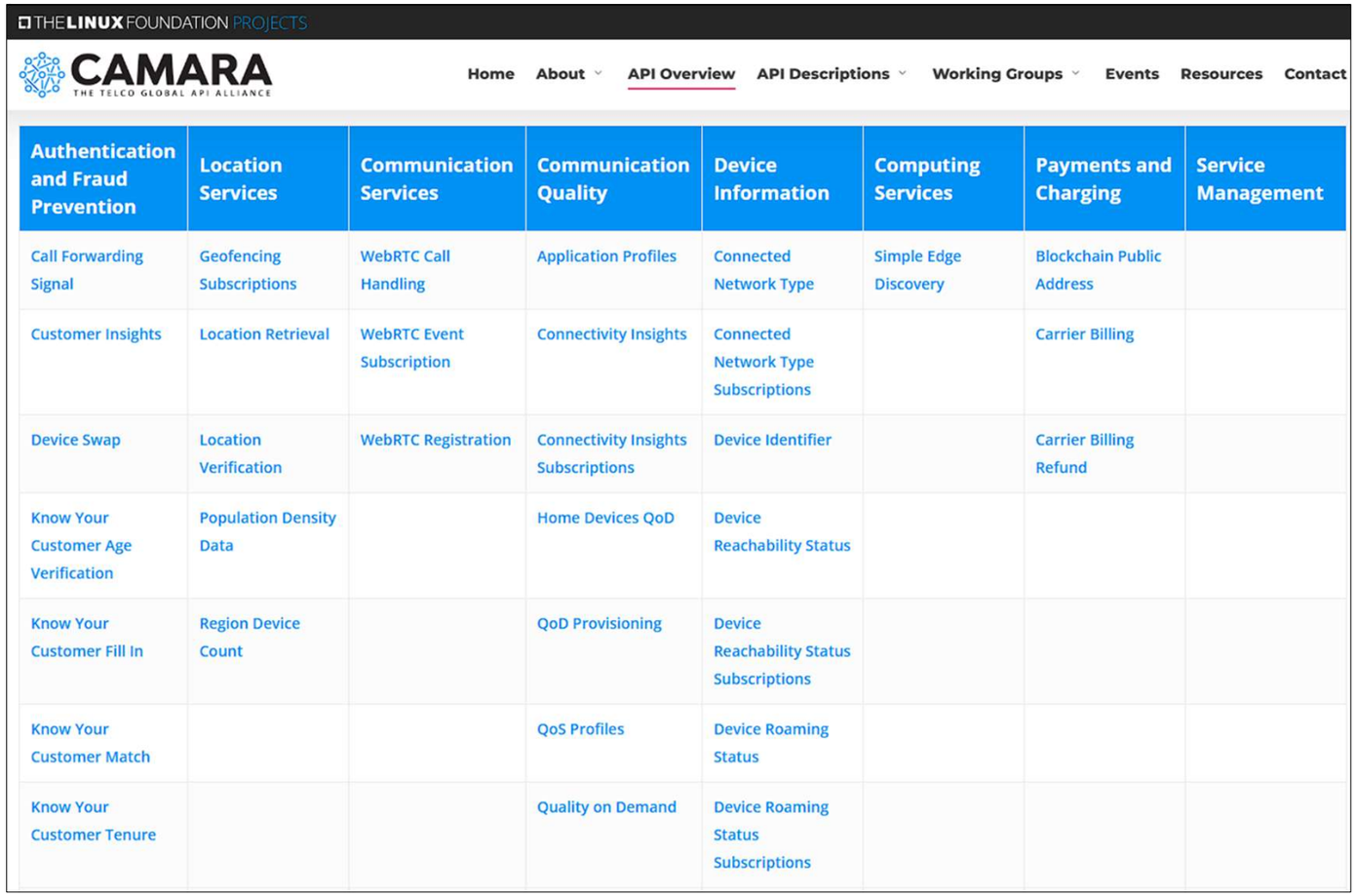
Release Management
Release Cycle

- 2 meta-releases per year
  - Fall (in September)
  - Spring (in March)
- Continuous and overlapping cycles
  - Update of CAMARA guidelines
  - Development and updates of API definitions in CAMARA
  - Lab implementations and production deployments at network operators
- Tests of API release candidates
  - In operator (lab) implementations
  - Based on CAMARA test definitions
- Feedback in all phases
  - From (lab) implementations and deployments to CAMARA API definitions and guidelines
  - From API definition work to CAMARA guidelines



For details see: https://wiki.camaraproject.org/display/CAM/Meta-release+Process

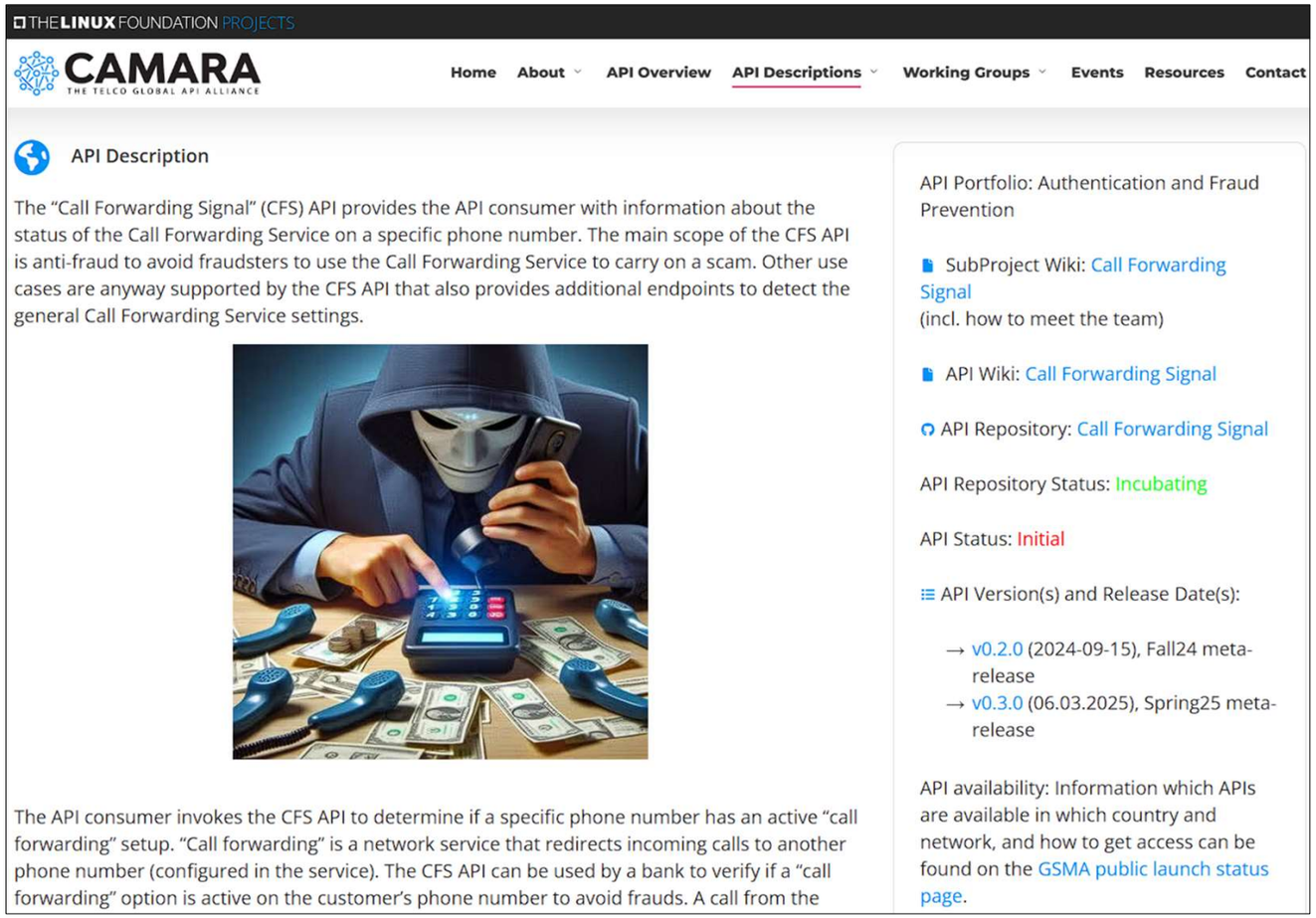
CAMARA API Overview



Authentication and Fraud Prevention	Location Services	Communication Services	Communication Quality	Device Information	Computing Services	Payments and Charging	Service Management
Call Forwarding Signal	Geofencing Subscriptions	WebRTC Call Handling	Application Profiles	Connected Network Type	Simple Edge Discovery	Blockchain Public Address	
Customer Insights	Location Retrieval	WebRTC Event Subscription	Connectivity Insights	Connected Network Type Subscriptions		Carrier Billing	
Device Swap	Location Verification	WebRTC Registration	Connectivity Insights Subscriptions	Device Identifier		Carrier Billing Refund	
Know Your Customer Age Verification	Population Density Data		Home Devices QoD	Device Reachability Status			
Know Your Customer Fill In	Region Device Count		QoD Provisioning	Device Reachability Status Subscriptions			
Know Your Customer Match			QoS Profiles	Device Roaming Status			
Know Your Customer Tenure			Quality on Demand	Device Roaming Status Subscriptions			

- https://camaraproject.org/api-overview/
- Mature APIs
- APIs in earlier development

API Descriptions



- API description
- Use Cases
- Benefits

- Links to
  - Sub Project (contacts)
  - API Wiki
  - API repository
  - API version(s)
  - GSMA public launch status

How CAMARA Works

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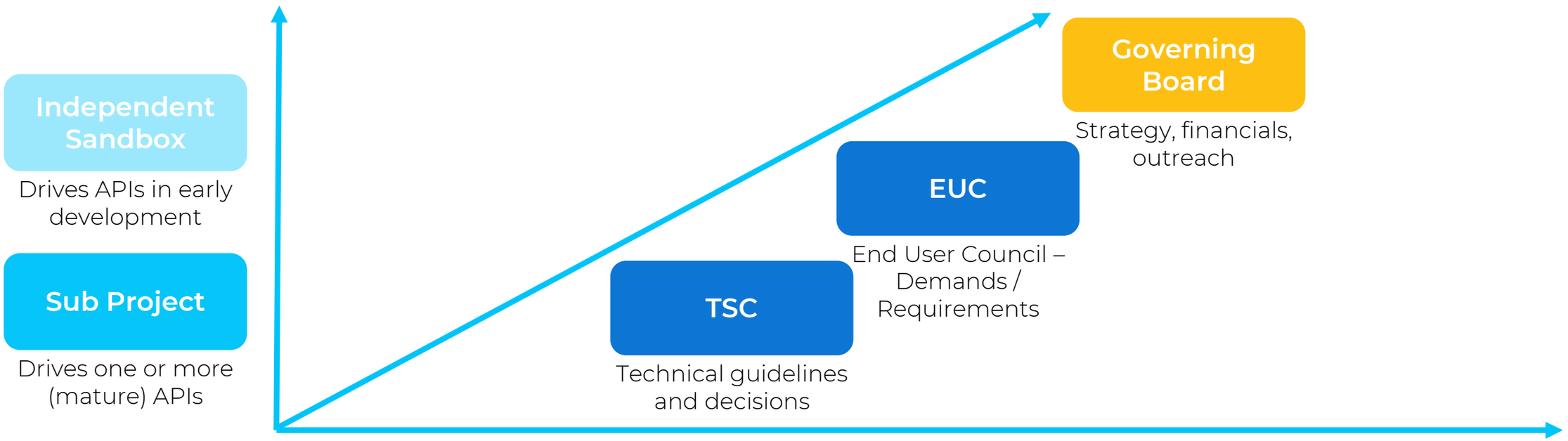

API Backlog
Maintains the API Backlog for CAMARA

Common-alities
Guidelines and assets mandatory for all CAMARA Sub Projects

Identity and Consent Management
Provides solutions to capture, store and manage user consent

Marketing / Outreach
Plans and performs marketing activities for CAMARA

Release Management
Guidelines and assets for Release Management in CAMARA

CAMARA / Open Gateway API Showcases

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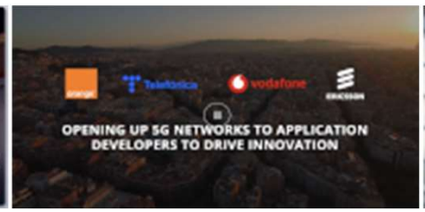
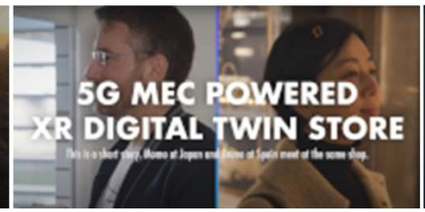
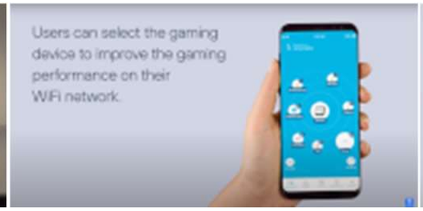
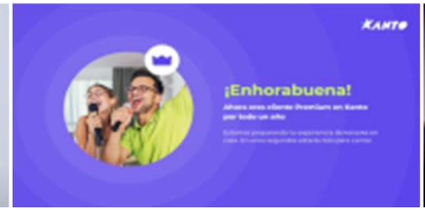
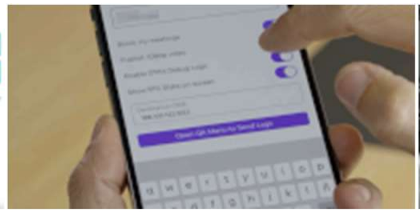




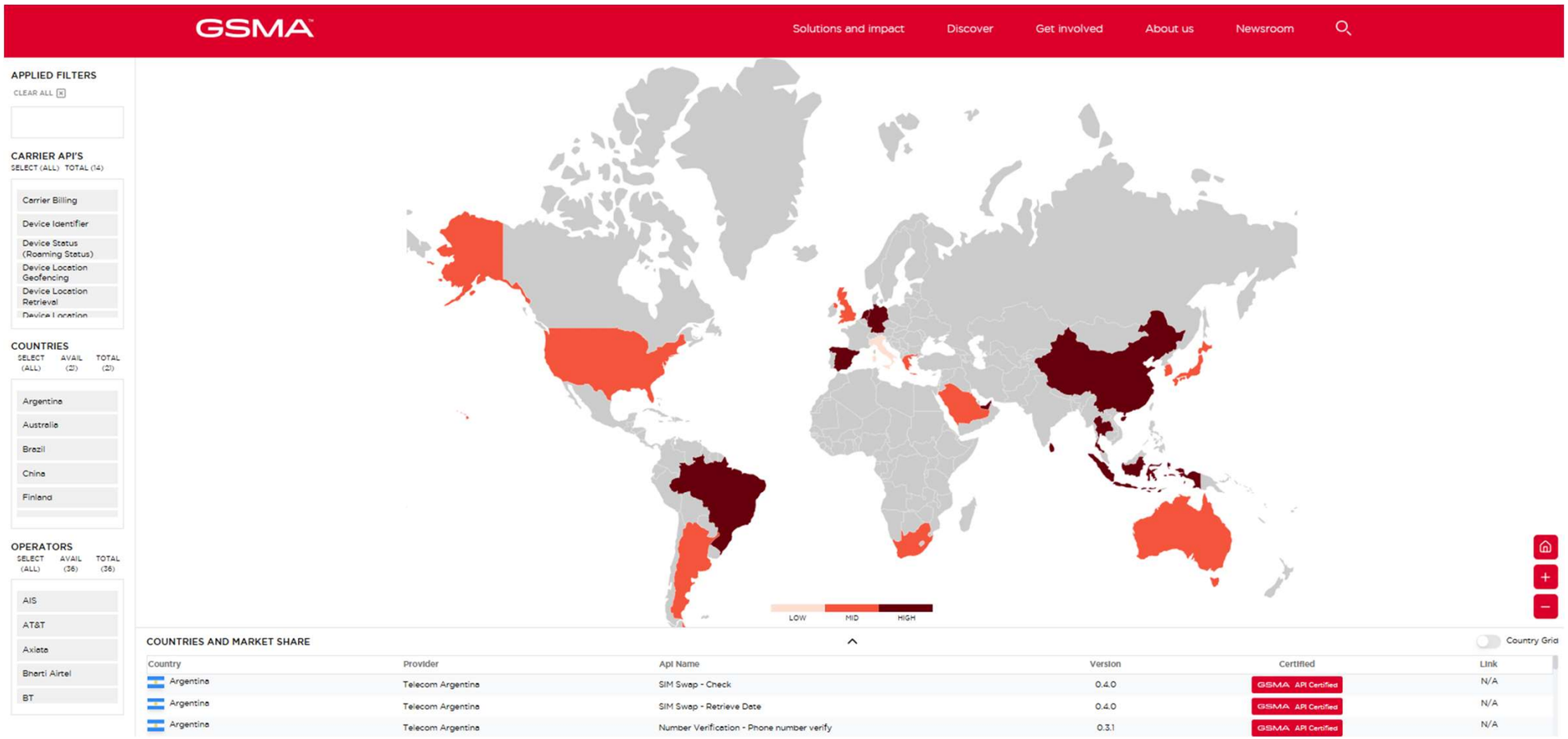






https://camaraproject.org/resources/

CAMARA / Open Gateway
API public launch status



https://open-gateway.gsma.com/

CAMARA / Open Gateway API public launch status

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Commitment

118 *73* operator groups and *45* Channel Partners supporting the Open Gateway MOU

284 operator networks represented

>78% of mobile connections represented

Assets

48 APIs published in CAMARA

53 APIs in Development

Technical

Standardization through certification
Certified APIs

Commercial

Open Service Agreement, Channel Partner On-Boarding and E-W Federation Agreement Templates

Impact

198 commercial API launches

14 market champion launches with align GTM services, engaged with *50* Markets

8,875

media mentions in 2025, 22K in 2024

5G network capabilities Introduction

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Telco network capabilities are functions partly available already in 4G but new and much more powerful in the 5G network. These functions enable to get information out of the network but also to configure the network.

The on-demand, secure and controlled exposure of these capabilities pave the way for transforming operator networks into service enablement platforms, facilitating the application-to-network integration, which will be key to deliver enhanced and service-tailored customer experience in the 5G era.

5G network capabilities
Introduction

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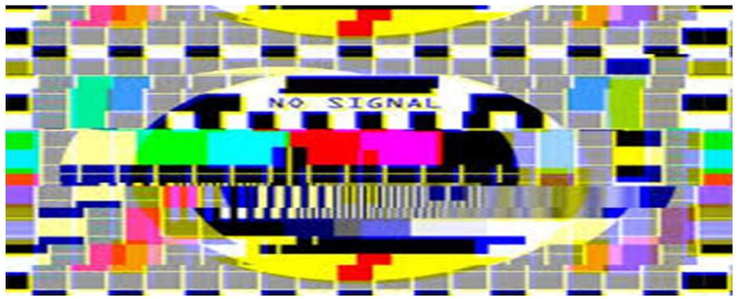
Reachability and Location of UEs
Identify (last known) location of drone

# of UEs in geographic region
Traffic jam or Corona warning

# of UEs in slice, network congestion
Adapt resolution for video transmission



Quality on Demand / Traffic influence
Enable augmented reality

Wake up UEs
Support low energy IoT devices

Block UEs in geographic region
Crisis management

Potential Business Use Cases

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Authentication and Fraud Prevention	Location Services	Communication Quality	Device Information	Computing Services
				
Secure Auth Fraud Prevention	Location Verification Location Retrieval Location Geofencing	Safeguarding of Transactions Remote Control AR/VR/XR Gaming	Proactive User Information	Edge Application hosting Latency optimization
Number Verify, Sim Swap, etc.	Location APIs	Quality on Demand	Device Data Volume	Simple Edge Discovery

Network APIs offer the opportunity

- For customers to optimize their use cases and applications
- For operators to monetize their invest in 5G infrastructure

It's a win-win!

Benefit for developers to use CAMARA APIs

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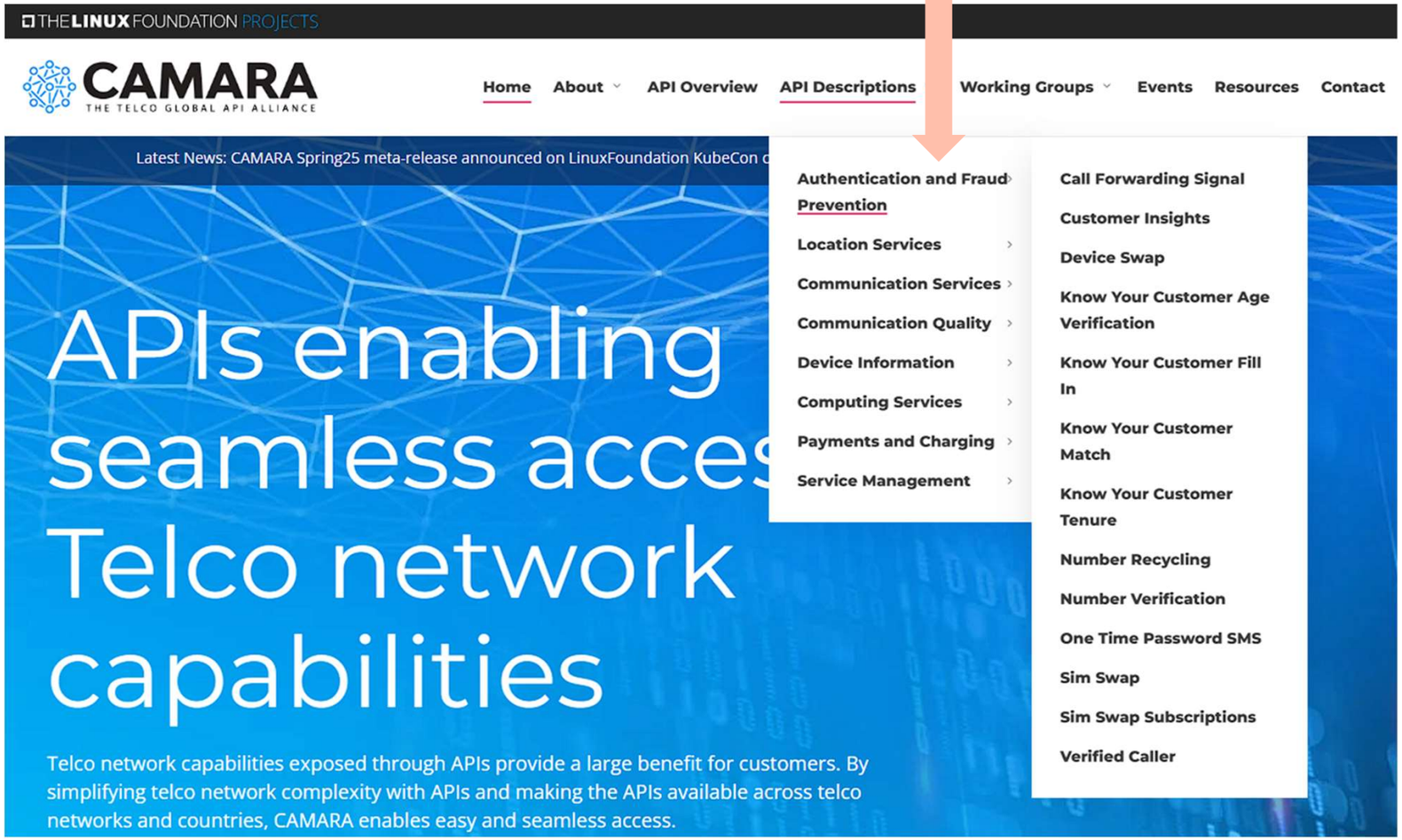
1. Reduces friction for developers to access network information across telcos globally.
2. Increases usage and value of telco networks by providing easy access to network capabilities.
3. Enables developers to create new applications or improve existing ones with access to these capabilities.

Additional revenue on existing assets, leveraging SDN and NFV capabilities

Developers Getting Started with CAMARA APIs



Developers Getting Started with CAMARA APIs

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API Description

The "Location Verification" API determines whether a mobile device is within the proximity of a specified geographical area. The API request includes the target area, defined as a circle with a specified center (latitude and longitude) and a radius or accuracy threshold. The API response confirms whether the location detected by the mobile network operator falls within the requested accuracy range.

Depending on the version of the API, other request and response parameters can be used. For example, the request can specify the maximum accepted age of the location information used in the verification, and the response can give information about such age and how the detected location matches the requested one.

Use Cases

→ **Fraud prevention in location-dependent transactions for Banking and Financial Services**: For example, if someone attempts to withdraw cash from an ATM or make a payment using your credit card number in a city within your country where you are not physically present

API Portfolio: Location Services

SubProject Wiki: Device Location (incl. how to meet the team)

API Wiki: Location Verification

API Repository: Device Location

API Repository Status: Incubating

API Status: Stable

API Version(s) and Release Date(s):

→ v0.2.0 (27.02.2024), second alpha version
→ v1.0.0 (10.09.2024), Fall24 meta-release
→ v2.0.0 (10.03.2025), Spring25 meta-release

API availability: Information which APIs are available in which country and network, and how to get access can be found on the GSMA public launch status page.

Developers Getting Started with CAMARA APIs

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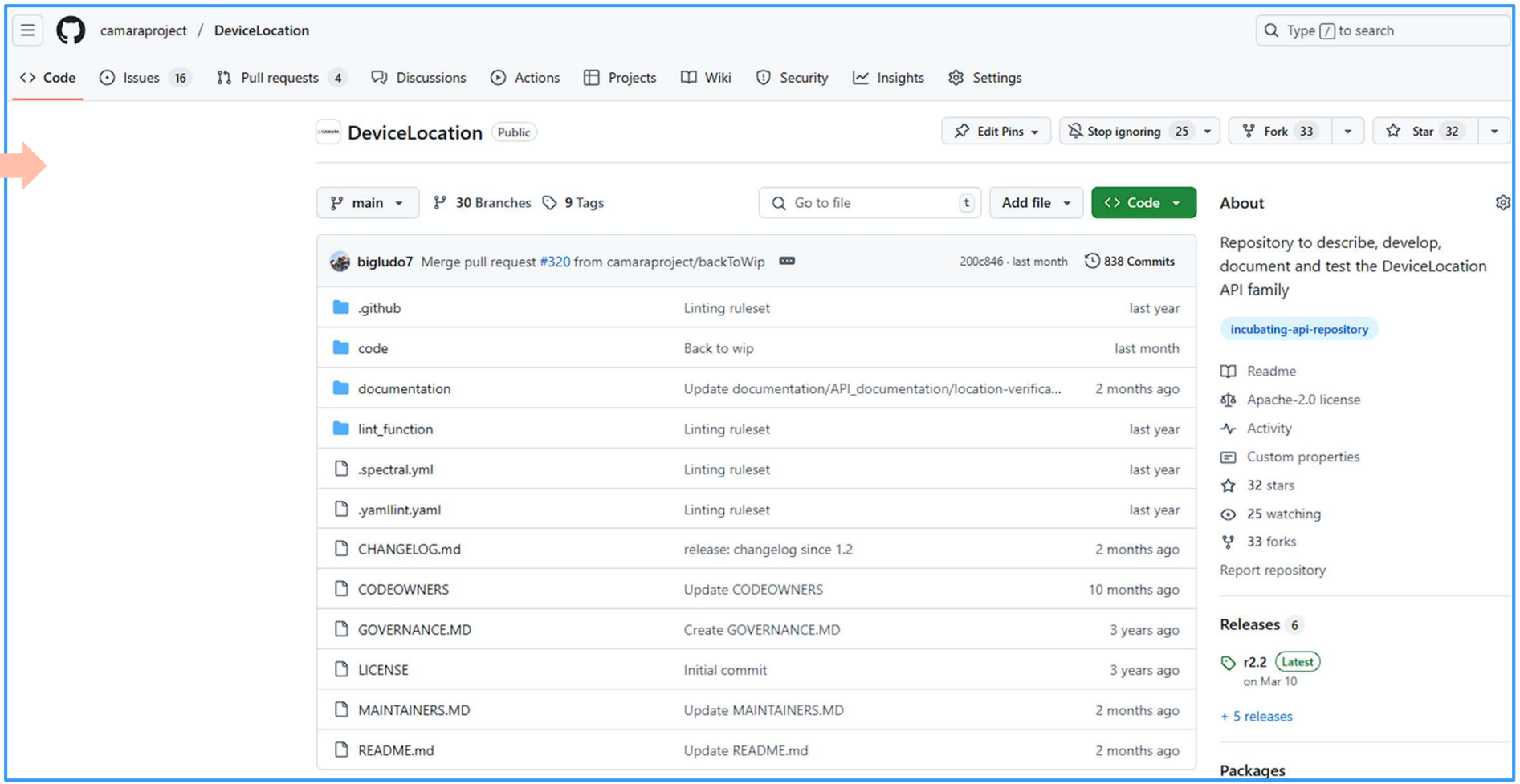

Benefit for developers to work in CAMARA

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As a typical Open Source Project **CAMARA is driven by contribution!**

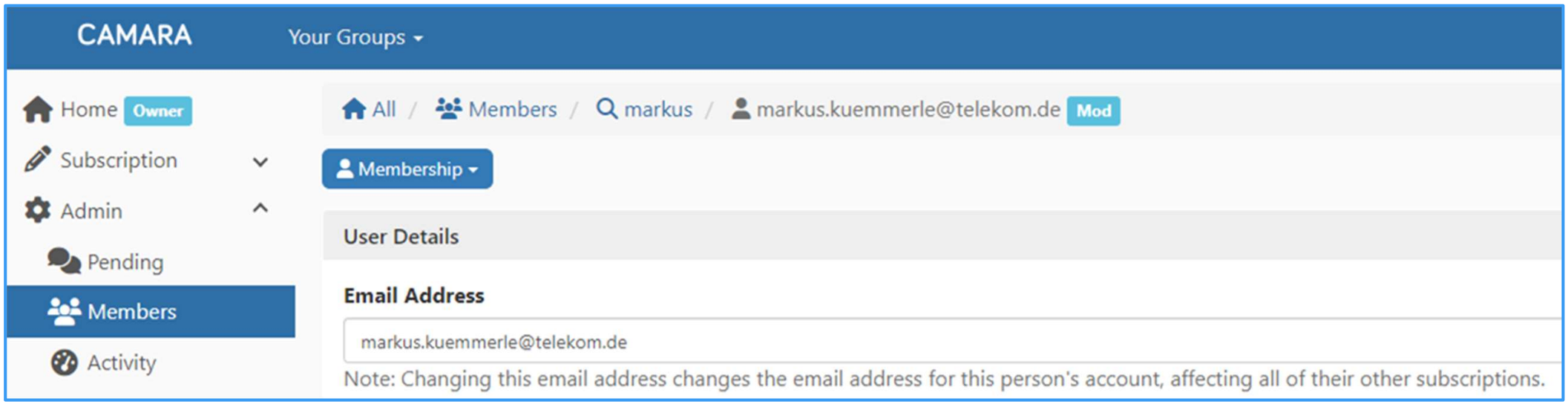
People who contribute define priorities and drive the direction.

Working in CAMARA on API definitions, API documentations and API code (transformation functions) enables to

- **Bring in own demand** and contribute a solution
- **Influence the definition** of new APIs and API versions
- Ensure that own requirements are considered
- **Provide code which can be used globally**
- **Learn** about CAMARA, Open Gateway and the Network API ecosystem
- **Get deep knowledge about the APIs**
- **Become maintainer and TSC member** to influence technical decisions in CAMARA

Joining CAMARA as Developer

To join the CAMARA mailing list send an (empy) email to all+subscribe@lists.camaraproject.org.

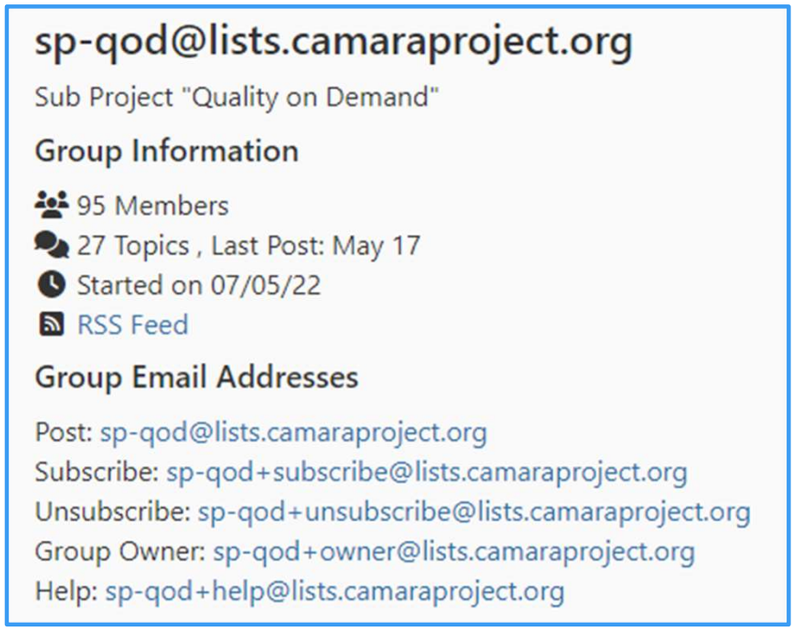


The CAMARA GitHub https://github.com/camaraproject can be accessed without any prerequisite. To create issues and start contributing to CAMARA you need a free GitHub account.

Joining CAMARA as Developer

Each API in CAMARA is developed in a separate repository under a Sub Project or as an Independent Sandbox with (example QoD):

- A dedicated lead repository (containing API definition and API documentation)
- 0…n provider implementation repositories (containing API code)
- A dedicated mailing list and meeting schedule to discuss progress/issues on the APIs



Joining a Sub Project as Developer

To join a Sub Project please have a look into its Readme.md (example Quality on Demand):

last commit april | issues 10 open | pull requests 2 open | contributors 27 | repo size 11.5 MiB | License Apache 2.0 | release r2.2

Incubating API Repository

QualityOnDemand

Incubating API Repository to evolve and maintain the definitions and documentation of QualityOnDemand Service API(s) within the Sub Project Quality On Demand

Scope

- Service APIs for "Quality on Demand" (see APIBacklog.md)
- The Service APIs provide the API consumer with the ability to:
  - retrieve the possible quality options (profiles) from the network (qos-profiles)
  - set the quality for a connection of a mobile device or a home device within the access network
    - dynamically, for a selected session of a specific duration (quality-on-demand)
    - provisioned, applying the same quality each time the device connects to the network (qod-provisioning)
  - get a notification if the network cannot fulfill the requested quality profile (quality-on-demand, qod-provisioning)
- Describe, develop, document and test the APIs (with 1–2 Service Providers)
- Started: October 2021
- Incubating stage since: February 2025

- Meetings are held virtually: Meeting registration / Join
- Schedule: bi-weekly, Friday, 2 PM CET/CEST (13:00 UTC, 12:00 UTC during European DST). For date/time of next meeting see previous meeting minutes.

Status and released versions

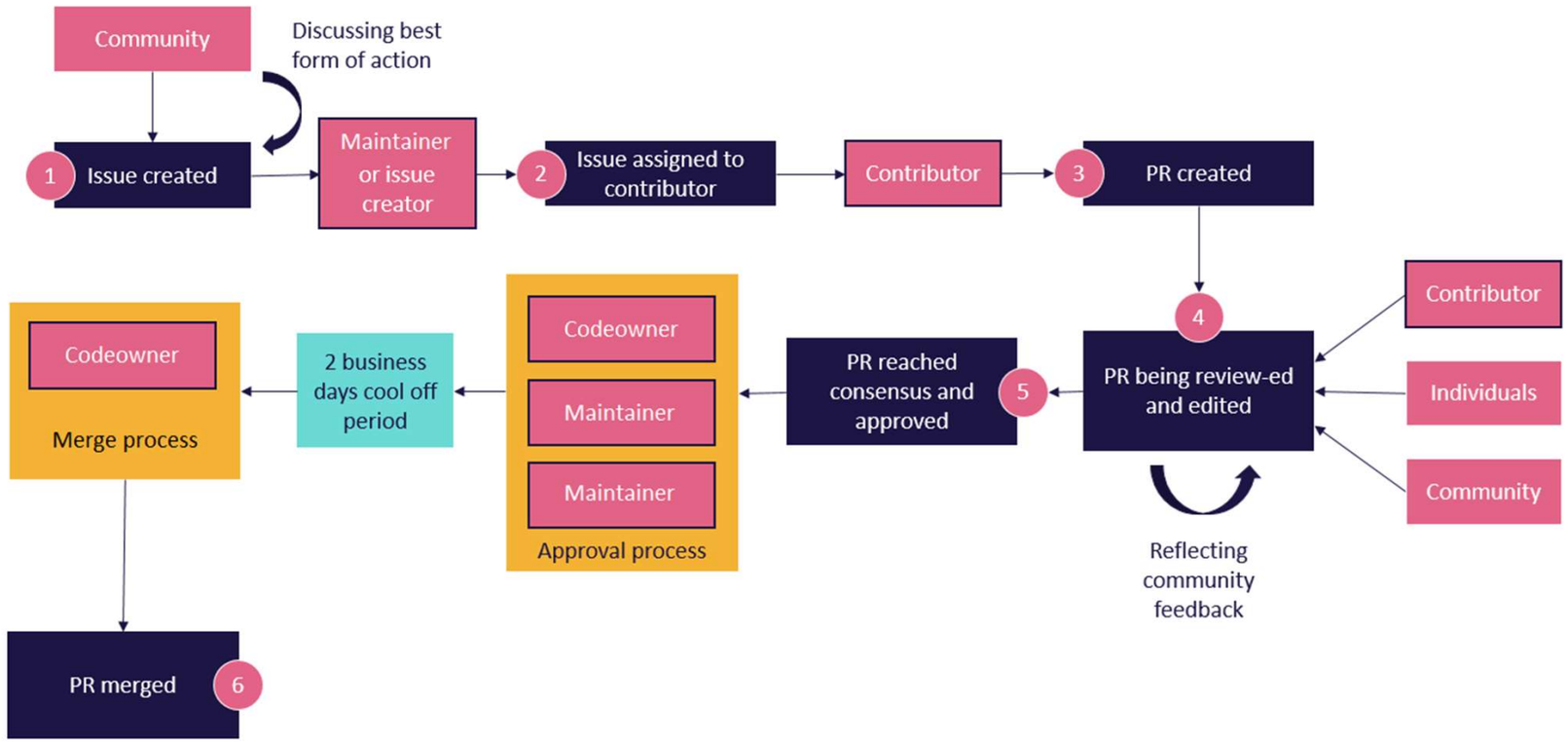
- Note: Please be aware that the project will have frequent updates to the main branch. There are no compatibility guarantees associated with code in any branch, including main, until a new release is created. For example, changes may be reverted before a release is created. **For best results, use the latest available release.**
- **The latest available and released version 0.10.1 is available here**
  - API definition v0.10.1 with inline documentation:
    - View it on ReDoc
    - View it on Swagger Editor
    - OpenAPI YAML spec file
- The previous released version v0.9.0 is availabe within the release-0.9.0 branch
- For changes between v0.10.0 and v0.9.0 see the CHANGELOG.md
- Provider implementations (PI) are available within separate repositories (partly for previous releases):
  - QualityOnDemand_PI1 by Deutsche Telekom
  - QualityOnDemand_PI2 by Orange
  - QualityOnDemand_PI3 by Spry Fox Networks

Contributorship and mailing list

- To subscribe / unsubscribe to the mailing list of this Sub Project and thus be / resign as Contributor please visit https://lists.camaraproject.org/g/sp-qod.
- A message to all Contributors of this Sub Project can be sent using sp-qod@lists.camaraproject.org.

Contributing to CAMARA

In the Project the “Fork and pull model” is used. Changes and contributions to CAMARA shall follow this process:



thttps://github.com/camaraproject/Governance/blob/main/ProjectStructureAndRoles.md

Benefit for operators to implement CAMARA APIs in their networks

CAMARA
THE TELCO GLOBAL API ALLIANCE

Operators have made high investments in

- Spectrum licenses
- Infrastructure (cell towers, fibre)

Operators haven‘t been successful in

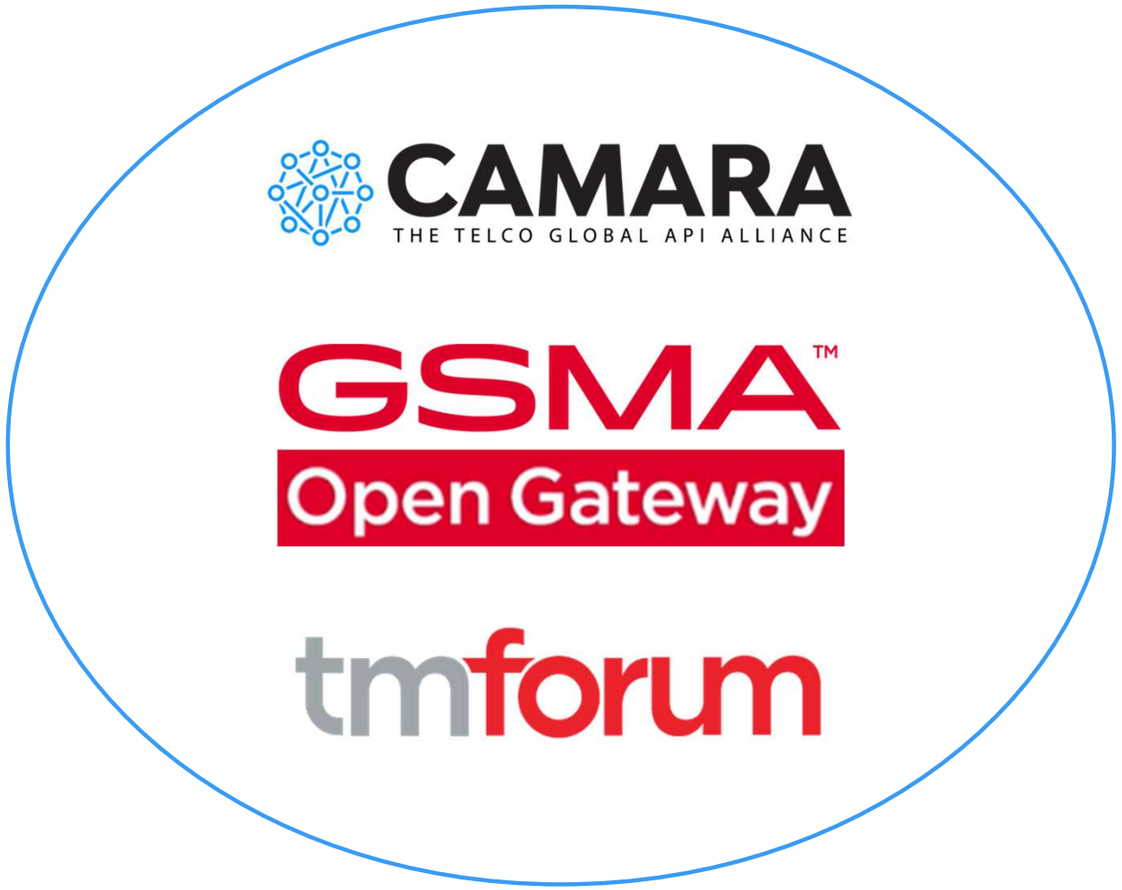
- Increasing prices for connectivity contracts

CAMARA APIs open opportunities

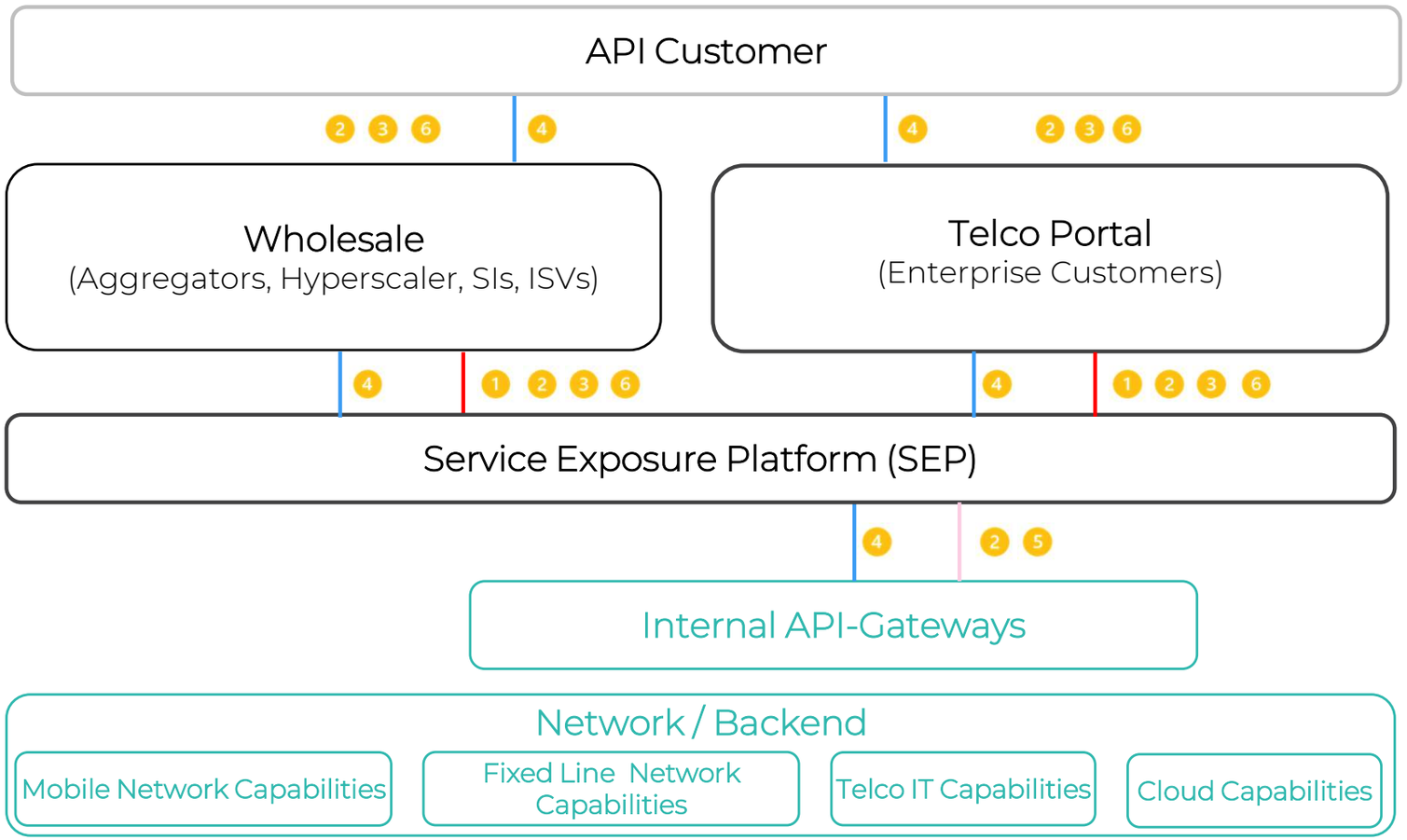
- To monetize the high investments
- To improve customer experience
- For market positioning

What have operators to do to implement Network APIs?

- Implement CAMARA APIs based on the network capabilities
- Implement an exposure infrastructure, with TMForum Operate APIs
- Define commercial products
- Sell it



What have operators to do to implement Network APIs?



Possible API workflows

1. Catalog published from SEP to portals
2. Customer onboarding to SEP
3. Customer orders API, SEP sends credentials to access API
4. If necessary SEP requests user consent for API. Capacity management is done. Customer uses API. SEP performs metering and rating.
5. SEP initates billing for wholesale and retail
6. Customer offboarding

Service API | IT API | Operate API

Benefit for operators to work in CAMARA

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Collaborative Innovation

- Industry Collaboration
- Standardization: contribute to development of industry standards, ensuring interoperability and consistency across networks and services
- Bring in your requirements!

Networking and Partnerships

- Access to a growing global network of industry leaders
- Technological Advancements
- Knowledge Exchange

Shared Resources

- Collaborative projects often lead to cost savings through shared resources and reduced duplication of efforts
- Benefit from the collective research efforts

Benefit for operators to work in CAMARA

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Why Join CAMARA as a sponsor /member?

- Seat on the Governing Board to influence CAMARA strategy
- Elevate your Brand
- Signal Support & Commitment to open API development
- Discounts on Linux Foundation events & programs
- Help ensure the Project continues to provide needed governance & infrastructure
- Platform to showcase thought leadership

Operators Getting Started with CAMARA

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Individuals and organizations who are application developers / API consumers (e.g. enterprises and startups), aggregators, cloud operators, telco operators, network equipment vendors, system integrators, and software vendors are welcome to join CAMARA.

For organizations:

- If you are interested to show your logo on the CAMARA website as **“Participating Organization”** send a .SVG version of it to adm@lists.camaraproject.org. Participation is free, without any fees or obligations.
- If you would like to become a **CAMARA sponsor** please don’t hesitate to use the enrollment link. The cost is depending on the kind of membership and the number of employees.
- Associate Members of The Linux Foundation can also join as **"Associating organization"** for free, without any fees or obligations.

CAMARA
Where are we going next...

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1	Additional APIs and roadmap sync across CSPs, Aggregators and Hyperscalers
2	API lifecycle management consistency, Documentation of API versioning and availability globally
3	Drive API Adoption (application developers and operators)

CAMARA Contacts

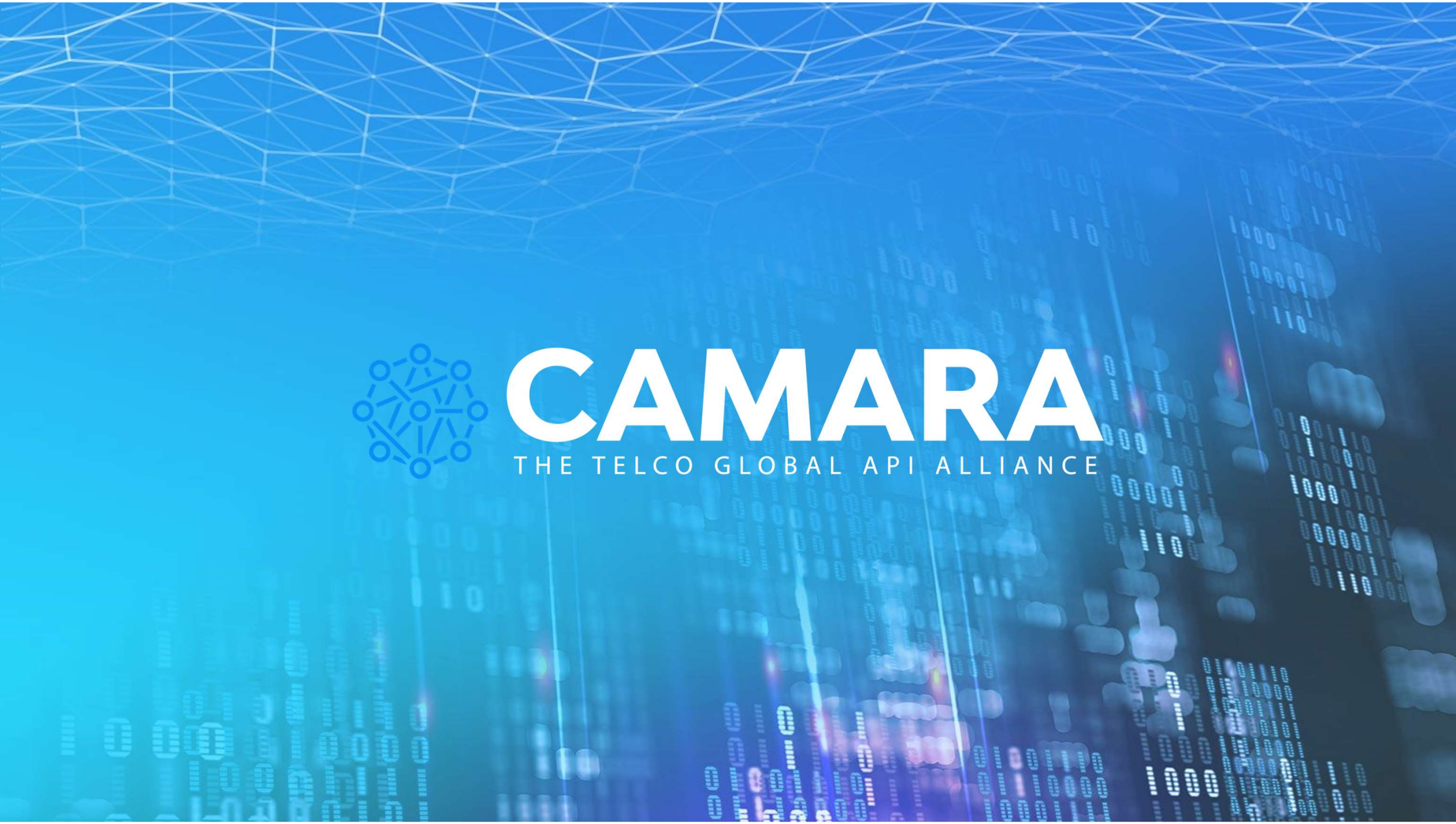
Individuals and organizations from application developers / API consumers (e.g. enterprises and startups), aggregators, cloud operators, telco operators, network equipment vendors, system integrators, and software vendors are welcome to join CAMARA.

To access CAMARA technical resources like API definitions, API specifications or API code just visit the CAMARA GitHub. All resources are reachable without any prerequisite. To create issues and start contributing to CAMARA you need a free GitHub account without any further prerequisite. This participation is free, without any fees or obligation to work.

If you are interested to be included in the CAMARA communication, please subscribe to all+subscribe@lists.camaraproject.org. You may unsubscribe from CAMARA and these communications at any time. Participation is free.

If you are interested to show your logo on the CAMARA website as “Participating Organization” you can send it to adm@lists.camaraproject.org. Participation is also free.

If you would like to join as CAMARA sponsor or associating organization, please don’t hesitate to use the enrollment link https://enrollment.lfx.linuxfoundation.org/?project=camarafund. Cost is depending on the kind of membership and the number of employees.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