CAMARA

THE TELCO GLOBAL API ALLIANCE

Presentation

27.03.2025

Content of the CAMARA presentation

CAMARA
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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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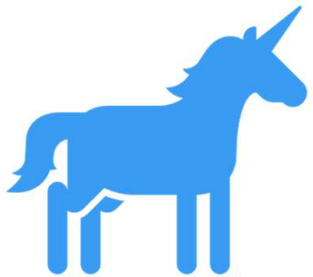
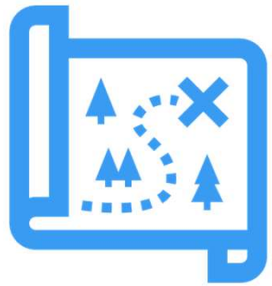


Scale

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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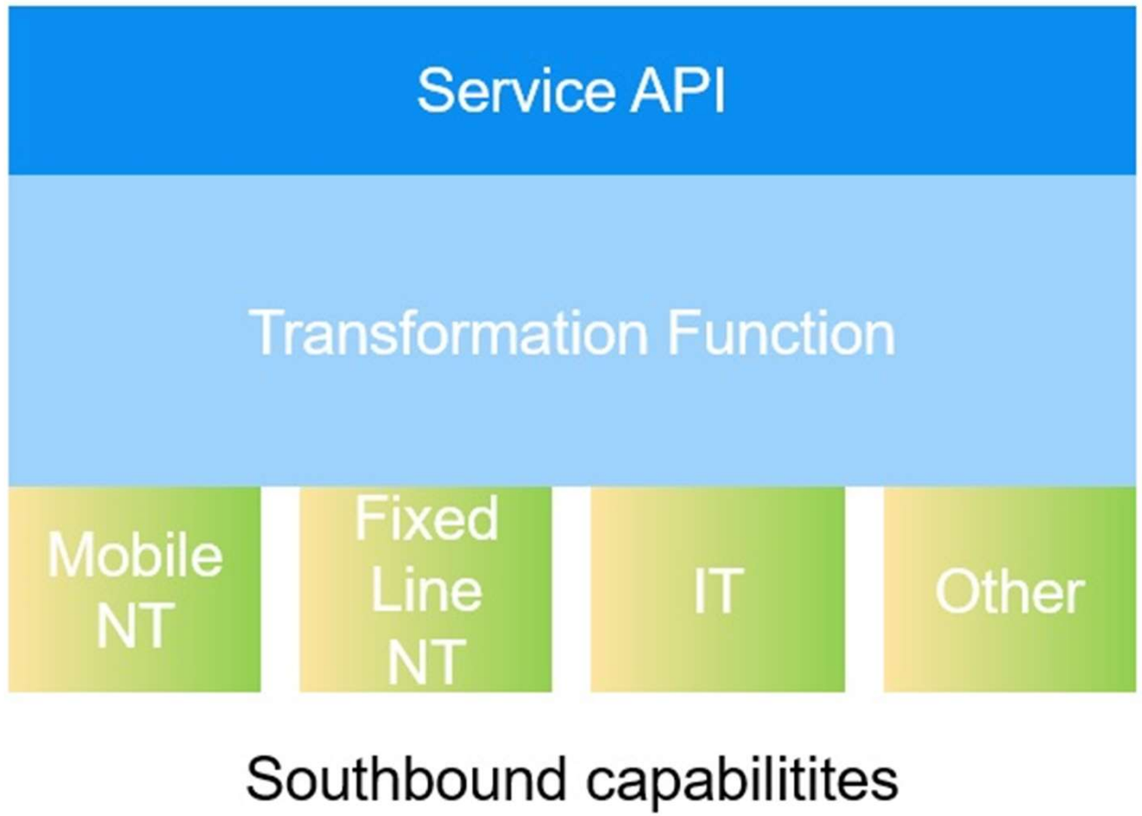
Abstraction from Network APIs to Service APIs is necessary:

- 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

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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 and APIs. 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).

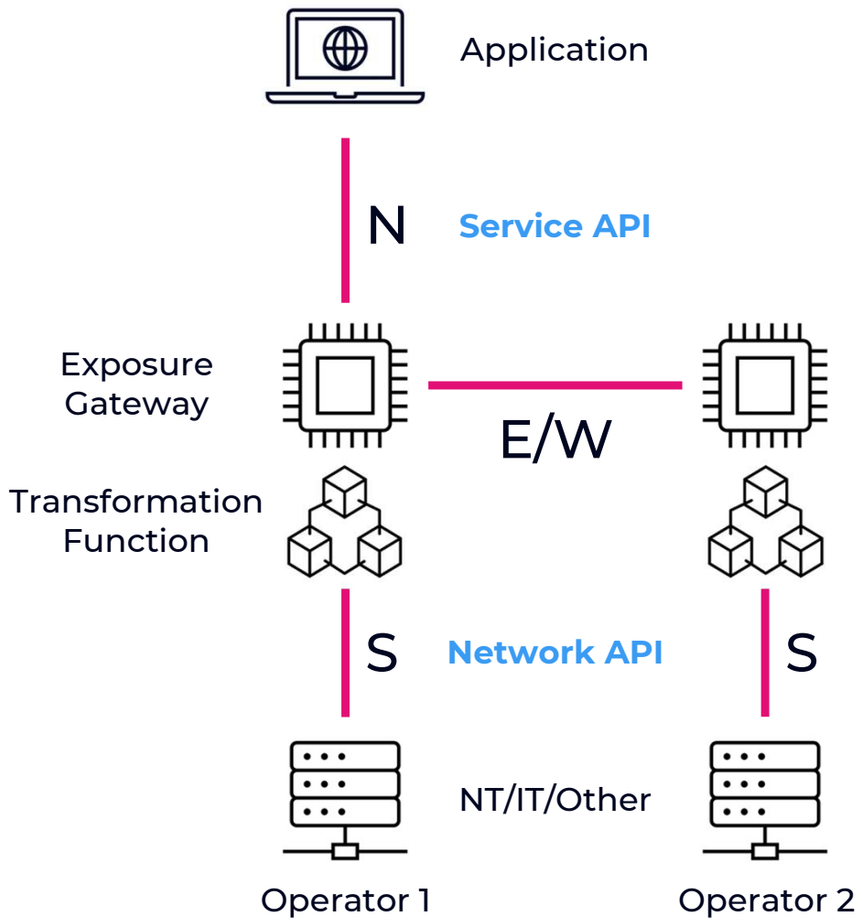
THE LINUX FOUNDATION

GSMA™

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.

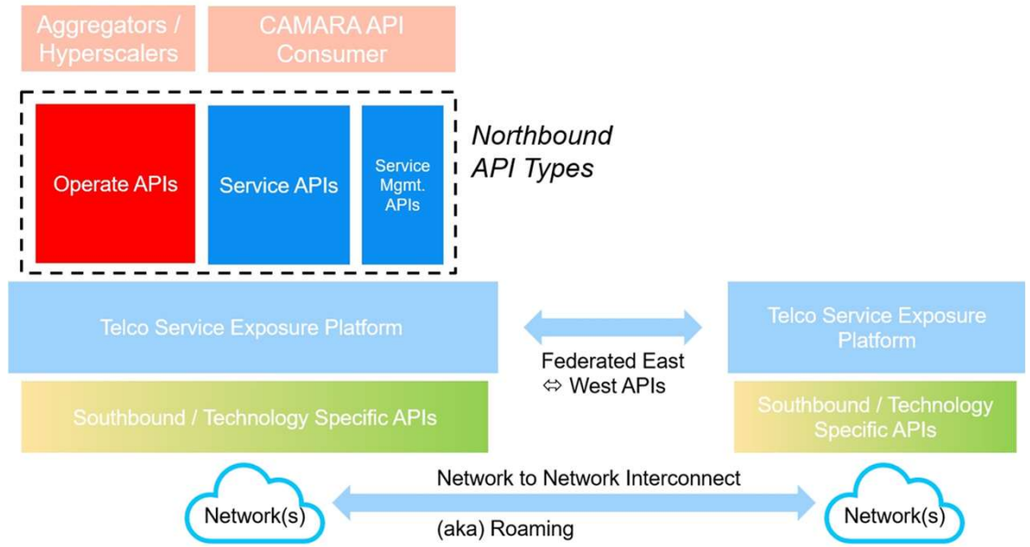
Thereby the focus is on the northbound interface (between telco operator and aggregator or capability consumer). East-/westbound interface APIs are out of scope for CAMARA.



CAMARA Scope

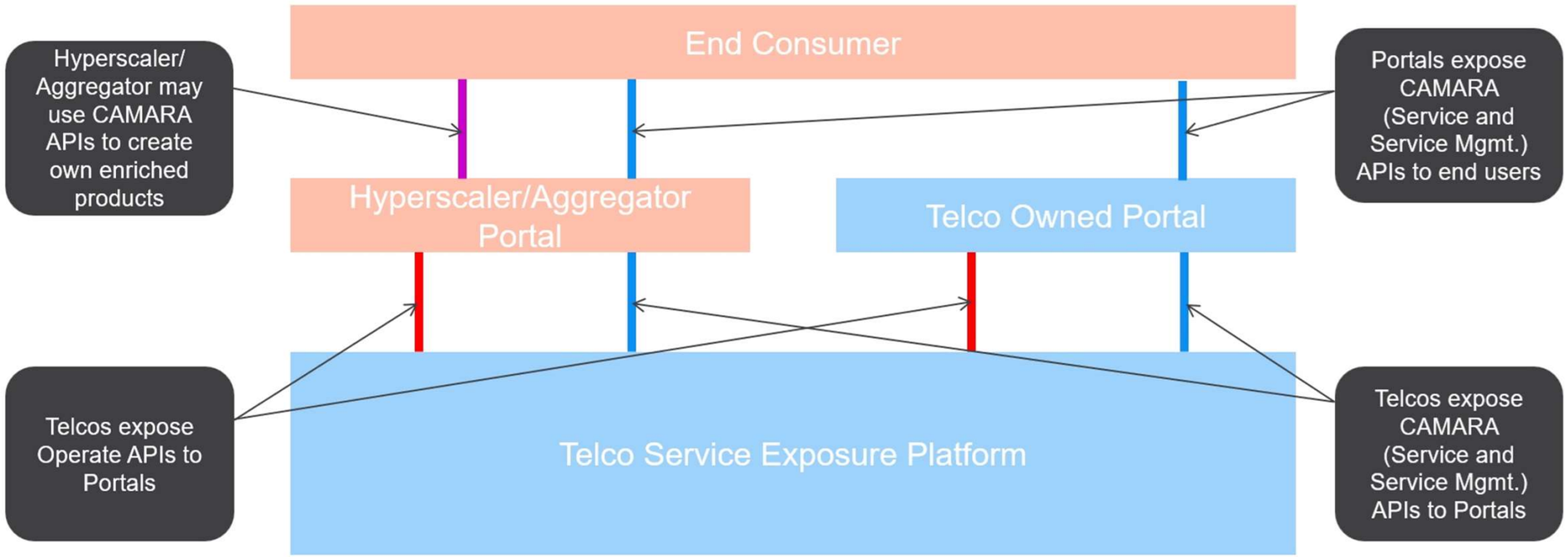
We differentiate between 3 types of Northbound APIs:

- **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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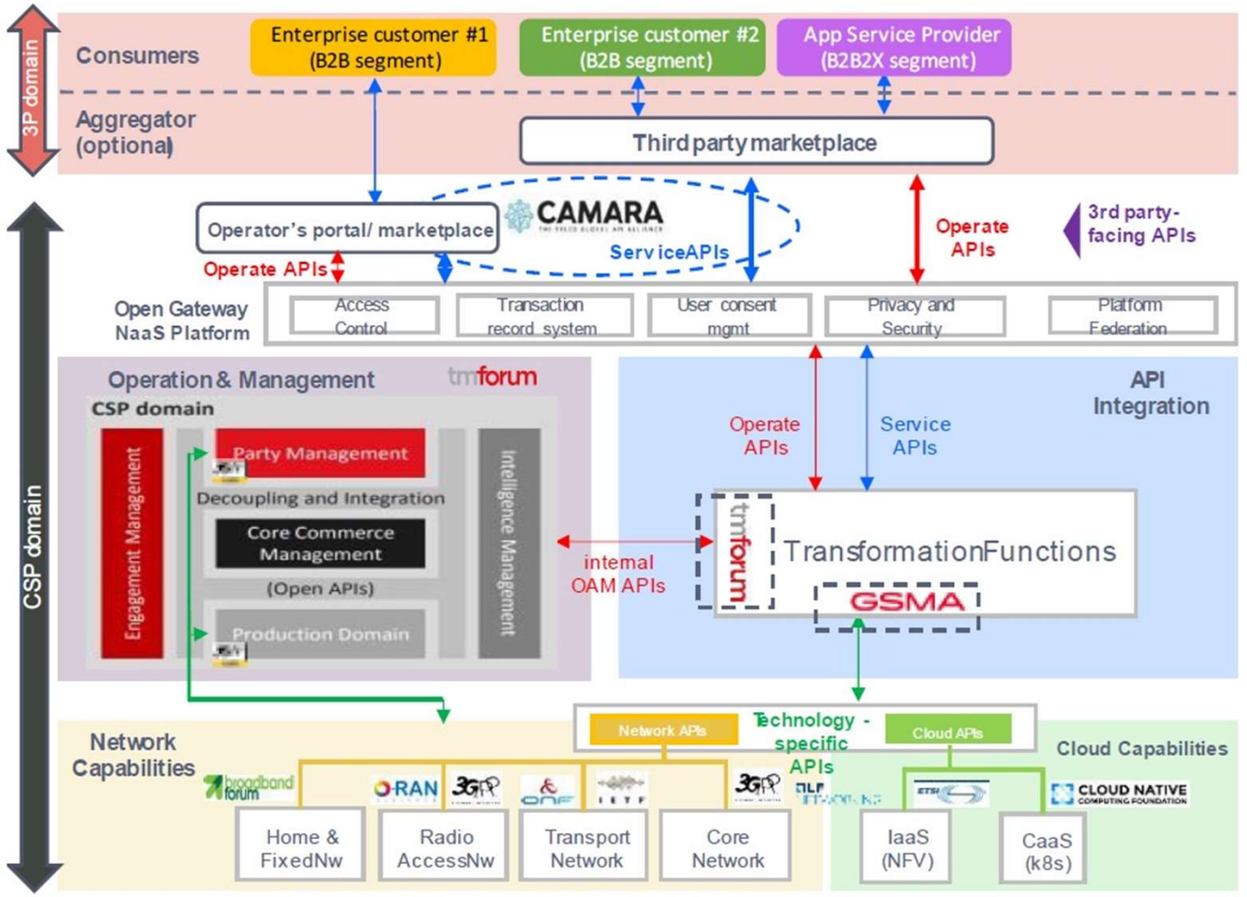

3rd Party-facing APIs

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: policy setting 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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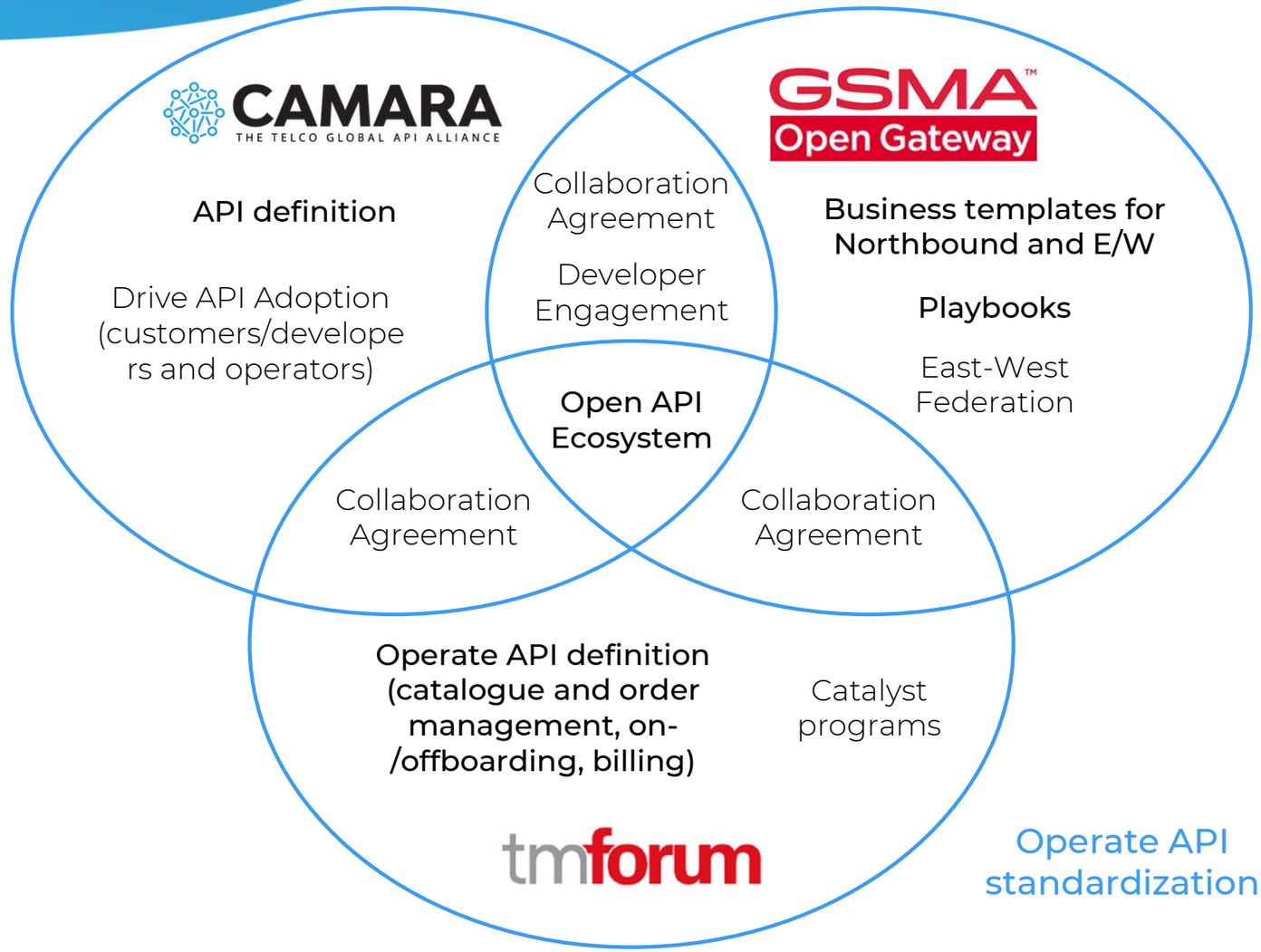
Service API "standardization"



Standardization of distribution channels

Operate API standardization

CAMARA Scope

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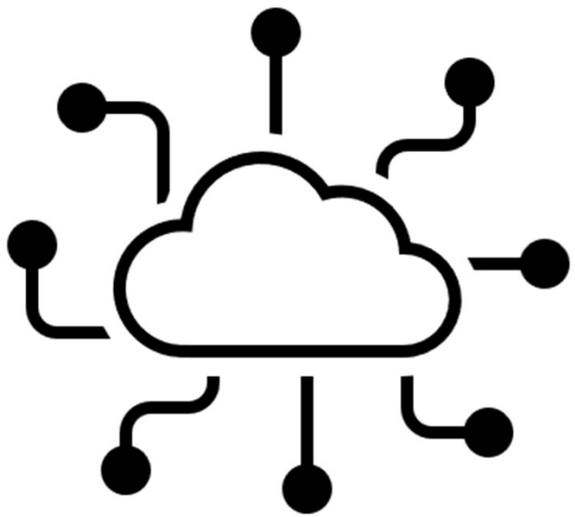
The scope of the CAMARA Project is:

- **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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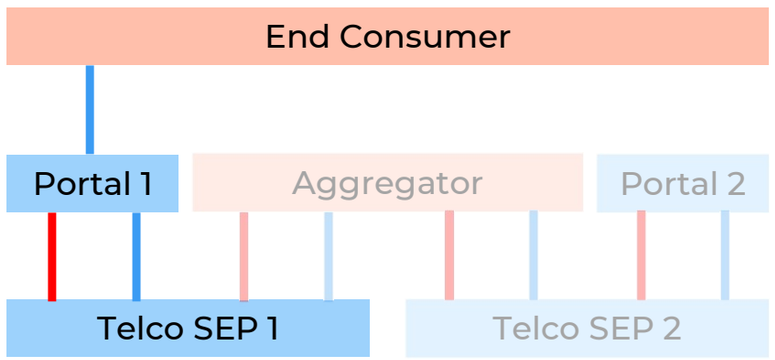
Single-Operator Relationship

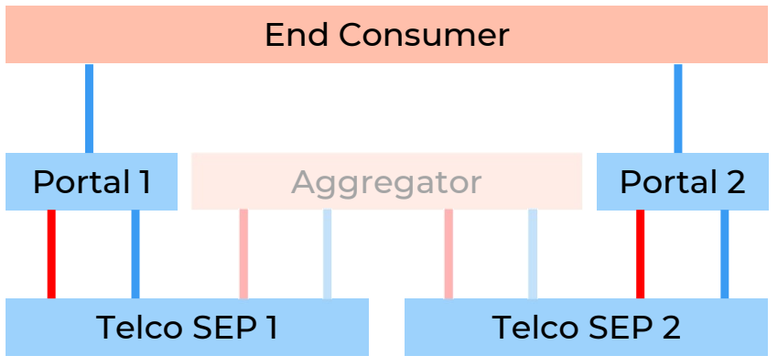


Blue lines = CAMARA APIs

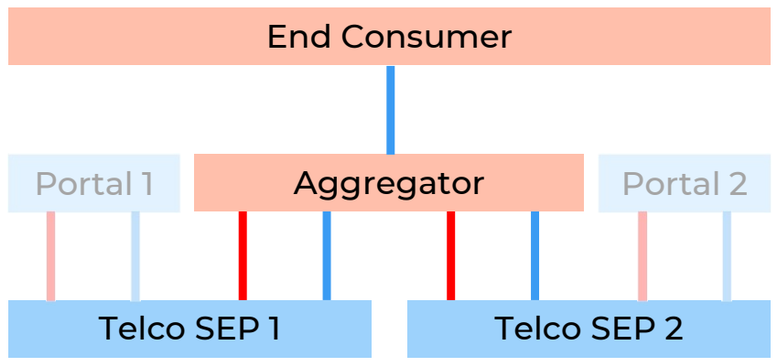
Red lines = Operate APIs

SEP= Service Exposure Platform

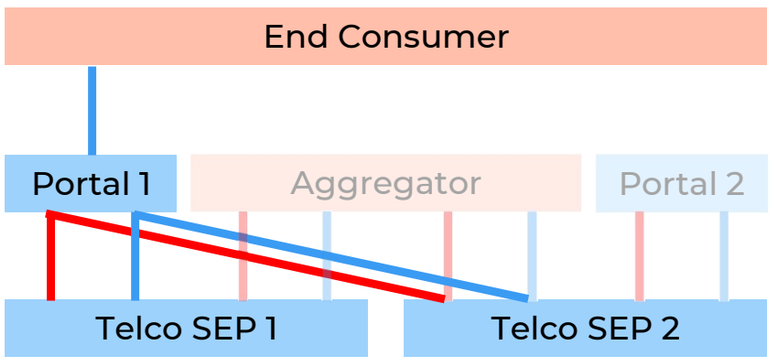
Multi-Operator Relationship



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 customer's voice and demand
- **Availability** – Open APIs with great support of many operators on many platforms
- **Alignment** - With standardization bodies like TM Forum 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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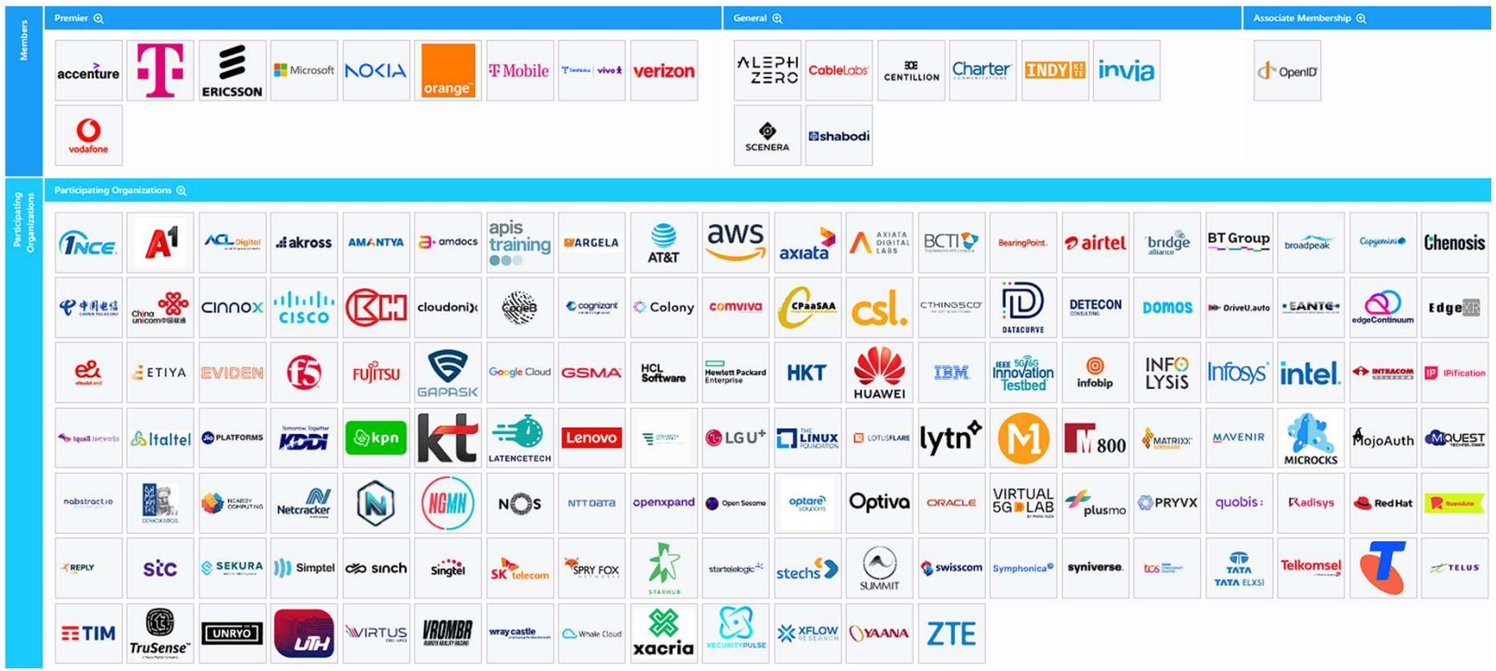

- 152 Named Partners
- 449 companies participating in CAMARA
- 11 API Sub Projects
  21 Sandbox Projects
  60 APIs
  5 Working Groups
- 1260 people joined CAMARA
- Development ”home” for GSMA Open Gateway

CAMARA Logos

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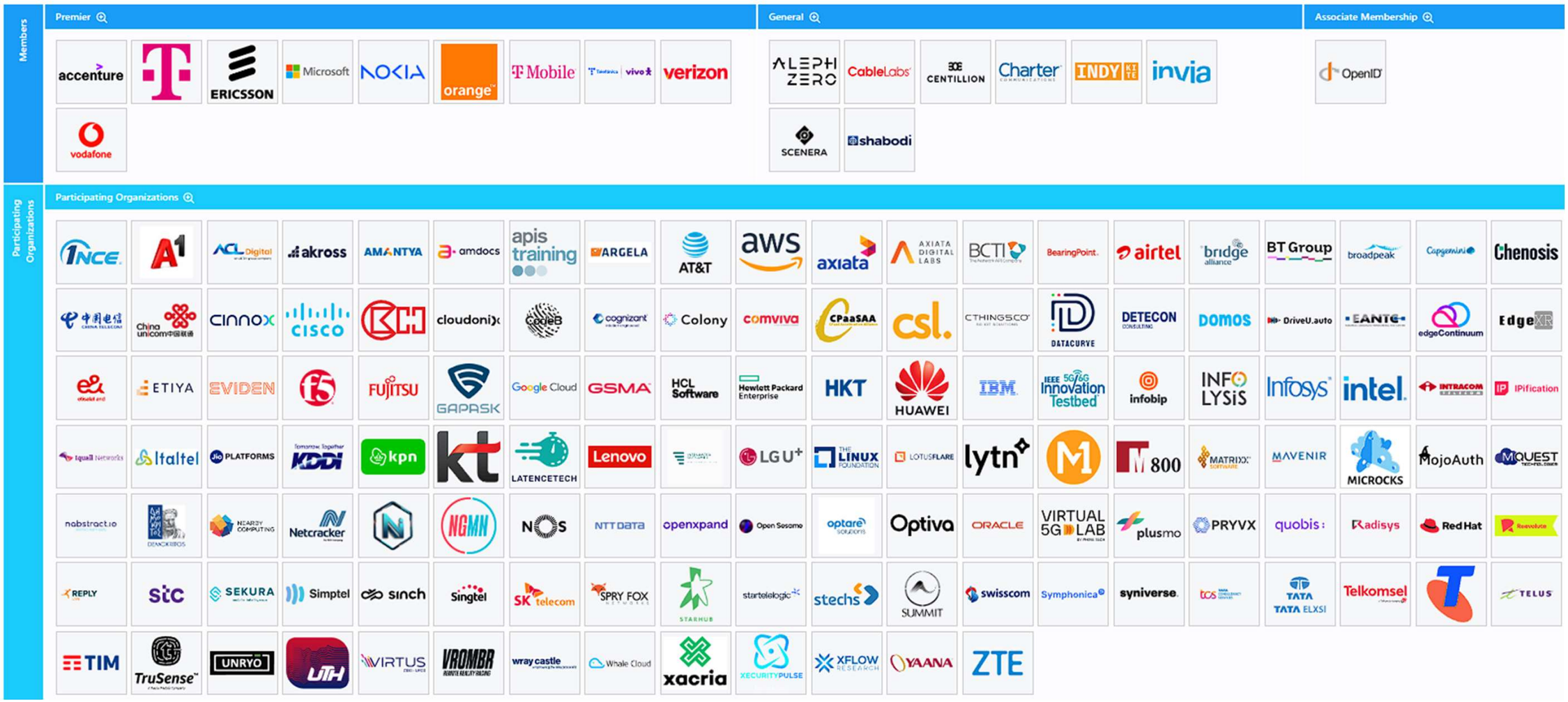

Release Management Motivation and Benefits

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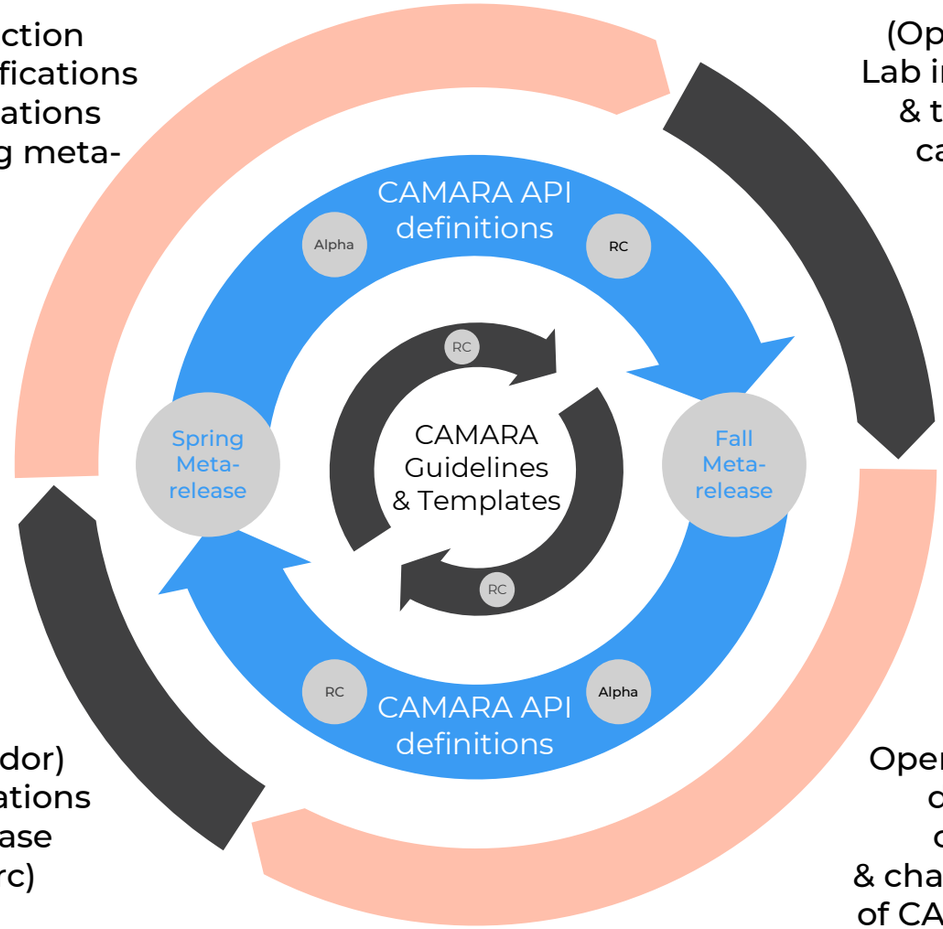
- A **CAMARA meta-release** combines a set of CAMARA API versions into a **consistent** release.
- There will be **two meta-releases per year** (in spring and fall).
  - Network operator can plan their implementations and deployments in production.
  - API consumers can plan the integration in their platform and applications.
- All API versions in a meta-release **fulfill defined quality criteria** and are **compliant to current CAMARA guidelines** like from CAMARA Commonalities and Identity and Consent Management.
- **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 releases each 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
  - Within 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

Operator production deployments, certifications & channel integrations of CAMARA Spring meta-release

(Operator/Vendor) Lab implementations & tests of release candidates (rc)



(Operator/Vendor) Lab implementations & tests of release candidates (rc)

Operator production deployments, certifications & channel integrations of CAMARA Fall meta-release

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

Stable APIs

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Stable CAMARA APIs (>= v1.0.0)

Previous versions launched in at least one market[1]


1.0..0

Device Reachability Status (Device Status)


1.0.0

Device Roaming Status (Device Status)


2.0.0

Location Verification (Device Location)


2.0.0

Number Verification


1.1.0

One Time Passwort SMS (Number Verification)


1.0.0

QoS Profiles (Quality on Demand)


1.0.0

Quality on Demand


2.0.0

Sim Swap (Number Verification)


1.0.0

Simple Edge Discovery (Edge Cloud)

Initial APIs

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Initial APIs (v0.y.z)

Public initial API version available

- Application Profiles (Connectivity Insights) 0.4.0
- Blockchain Public Address 0.2.0
- Call Forwarding Signal 0.3.0
- Carrier Billing 0.4.0
- Carrier Billing Refund 0.2.0
- Connected Network Type (Device Status) 0.1.0
- Connected Network Type Subscriptions (Device Status) 0.1.0
- Connectivity Insights 0.5.0
- Connectivity Insights Subscriptions 0.5.0
- Customer Insights 0.1.1
- Device Identifier 0.2.0
- Device Reachability Status Subscriptions (Device Status) 0.7.0
- Device Roaming Status Subscriptions (Device Status) 0.7.0
- Device Swap 0.2.0
- Geofencing Subscriptions (Device Location) 0.4.0
- Home Devices QoD 0.4.0
- KYC[1] Age Verification 0.1.0
- KYC[1] Match 0.3.0
- KYC[1] Fill-In 0.3.0
- KYC[1] Tenure 0.1.0
- Location Retrieval (Device Location) 0.4.0
- Number Recycling (KYC[1]) 0.1.0
- Population Density Data 0.2.0
- QoD Provisioning (Quality On Demand) 0.2.0
- Region Device Count 0.1.0
- SCAM Signal (GSMA) ?
- SIM Swap Subscriptions (Number Verification) 0.120
- WebRTC Call Handling 0.2.0
- WebRTC Event Subscription 0.1.0
- WebRTC Registration 0.2.0

1 KYC = Know Your Customer

Upcoming APIs

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Upcoming APIs

Work in progress or newly started

- Application Endpoint Discovery (Edge Cloud)
- Capability And Runtime Restrictions
- Click To Dial
- Consent Info (Identity and Consent Management)
- Device Data Volume (Device Status)
- Device Data Volume Subscriptions (Device Status)
- Device Quality Indicator (Device Status)
- Device Visit Location
- Edge Application Management (Edge Cloud)
- Energy Footprint Notification
- Most Frequent Location
- Network Access Management (Home Devices QoD)
- Network Slice Booking
- QoS Booking (Quality on Demand)
- Session Insights (Connectivity Insights)
- Site to Cloud VPN
- SMS
- SMS Delivery Notification Subscription
- Subscription Status (KYC[1])
- Traffic Influence (Edge Cloud)
- Verified Caller

1 KYC = Know Your Customer

Current CAMARA Sub Projects / Sandbox Projects

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Blockchain Public Address
Manage a blockchain public address associated to a phone number

Call Forwarding Signal
Determine if a “call forwarding” service is enabled

Capabilities And Runtime Restrictions
Provide capabilitites and runtime restrictions

Carrier Billing CheckOut
Purchase, pay, and follow up on fulfilment of products

Click to Dial
Establish web-based communication by clicking an object

Connectivity Insights
Alerts the consumers if and when the QoS threshold has breached

Customer Insights
Provides an index or scoring related to the user's credit profile

Dedicated Networks
Requests / modifies / deletes a (logical) dedicated network

Device Identifier
Check the identity of the subscribers’ device

Device Location
Check the location of a device

Device Status
Check the network connection and roaming status of a device

Device Swap
Check if the MSISDN has had a change of device in the last 30 days

Dynamic Predictive Connect. Data
Information about the connectivity along a volume/area for a future date, time, height

Edge Cloud
Provide and manage network and compute resources for an application

Energy Footprint Notification
Provide information about the E2E energy consumption and carbon footprint

High Throughput Elastic Netw.
Calculates load-balancing paths with given duration, data and bandwidth

Home Devices QoD
Request prioritization of traffic on a specific device on the home network

IoT Device Management
Comprehensively manage the lifecycle of IoT devices

Current CAMARA Sub Projects / Sandbox Projects

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IoT Network Optimization
Enable specific IoT services (e.g. energy saving) for certain set of IoT devices

IoT SIM Fraud Prevention
Query risk control information related to IoT SIM

Know Your Customer
Allows service providers to validate user information with operators

Location Insights
Give insights to the home area and latest location of a device

Model as a Service
Build, deploy, monitor, and invoke LLM

Network Slice Booking
Reserve, dynamically provision, query, dynamically delete a slice

Number Verification
Allows users to verify the phone number of the connected device

Population Density Data
Get dynamic population density data in a specific area for a future date & time

Quality on Demand
Allows users to set mobile connection quality and get notifications

Region Device Count
Query the number of active devices in the specified area

Short Message Service
Send SMS to the destination address(es)

Site to Cloud VPN
Create and configure site to cloud network service by one click

Verified Caller
Show certified information on the phone before a call is answered

WebRTC
Add real-time communication capabilities to applications

Current CAMARA Working Groups

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API Backlog	Common-alities	Identity and Consent Management	Marketing / Outreach	Release Management
Maintains the API Backlog for CAMARA	Guidelines and assets mandatory for all CAMARA Sub Projects	Provides solutions to capture, store and manage user consent	Plans and performs marketing activities for CAMARA	Guidelines and assets for Release Management in CAMARA

CAMARA / Open Gateway API Showcases

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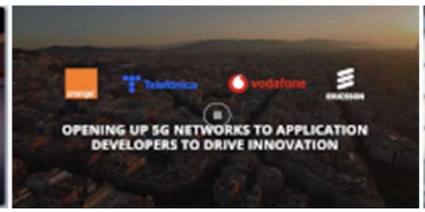
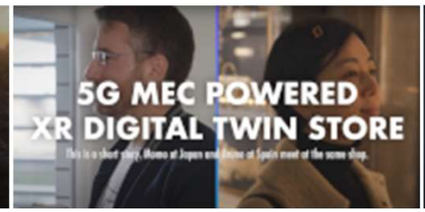
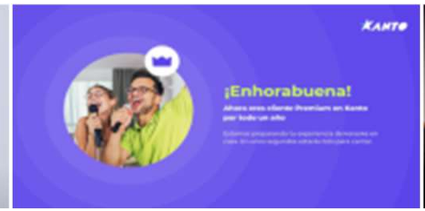
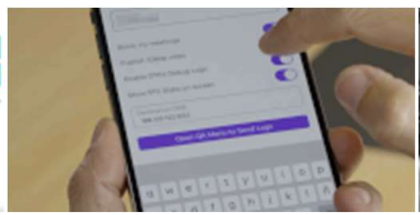


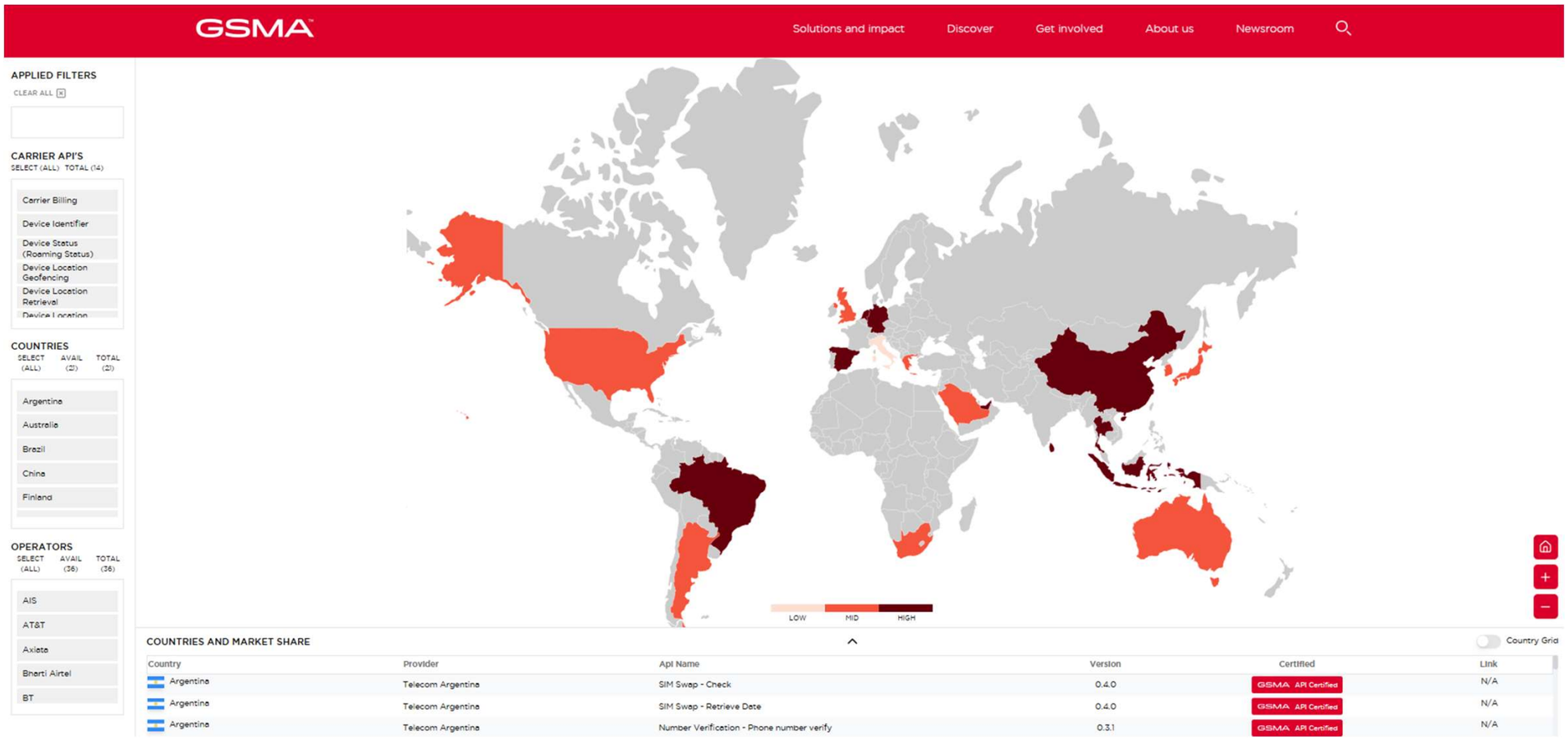






https://camaraproject.org/resources/

CAMARA / Open Gateway
API public launch status



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

CAMARA / Open Gateway API public launch status

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Commitment

108 ***72*** operator groups and ***36*** Channel Partners supporting the Open Gateway MOU

284 operator networks represented

>78% of mobile connections represented

Assets

46 APIs published in CAMARA

50 APIs in Development

Technical

Standardization through certification
Certified APIs

Commercial

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

Impact

220 Tracked commercial API launches across ***58*** networks in ***27*** markets

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

1,130 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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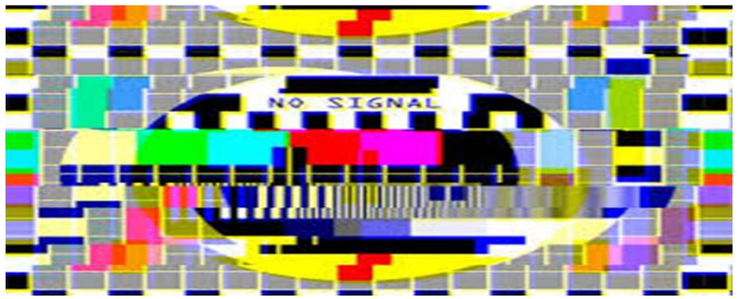
Reachability and Location of UEs
Identify (last known) location of drone

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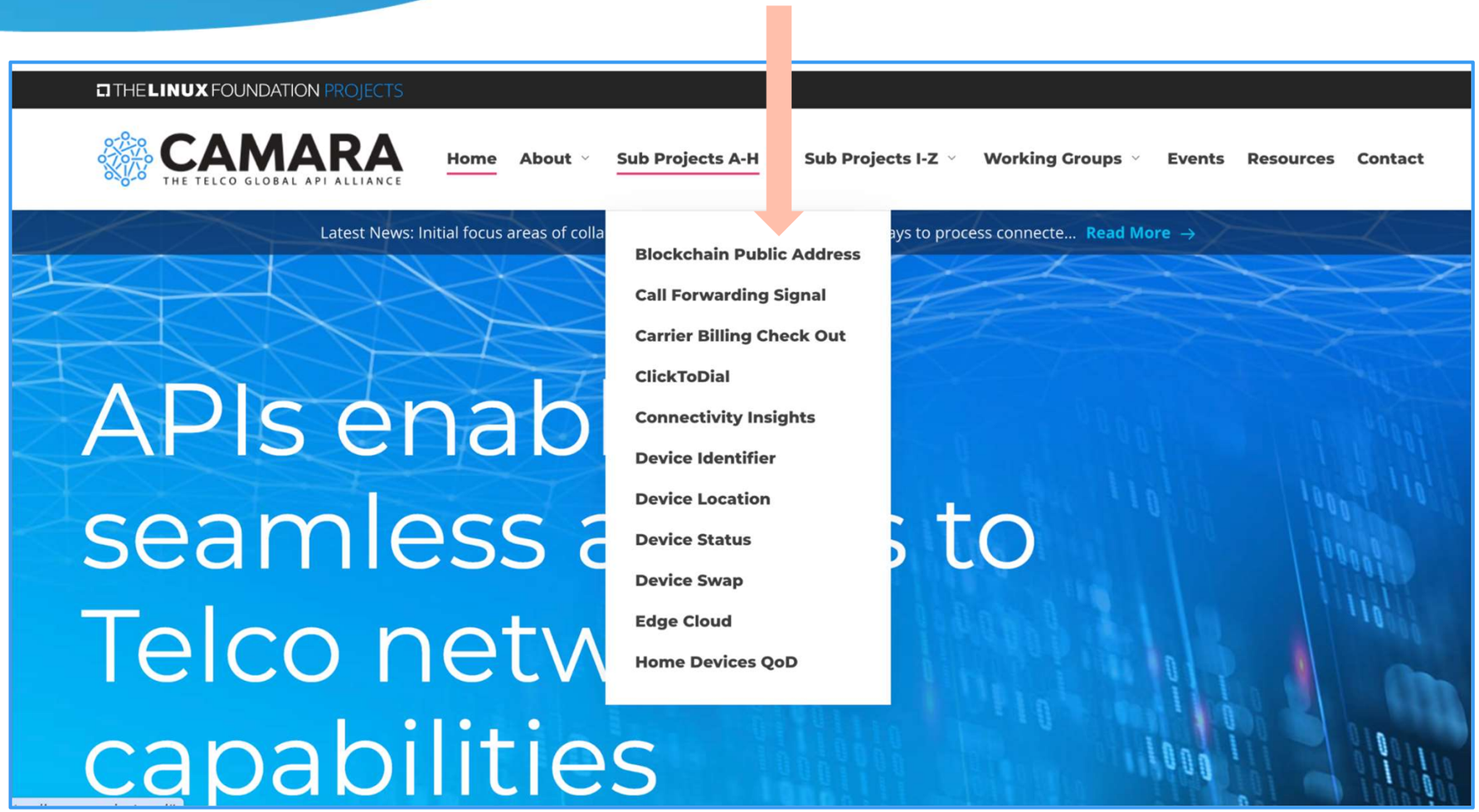
1. Reduces friction for developers to access network information across telcos globally.
2. Increases usage and value of telco networks by providing easy access to network capabilities.
3. Enables developers to create new applications or improve existing ones with access to these capabilities.

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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Quality on Demand

Scope

- → Service APIs for "Quality on Demand" (see APIBacklog.md)
- → It provides the customer with the ability to:
  - set quality for access network connections (e.g. mobile device connection or fixed access between a home gateway and the service providers gateway router)
  - get notification if network cannot fulfill
- → Describe, develop, document and test the APIs (with 1-2 Service Providers)
- → Started: October 2021
- → Location: virtually

Meetings

- → 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.

Results and Status

- → 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 0.10.0 is available within the release-0.10.0 branch**
  - API definition v0.10.0 with inline documentation:
    - View it on ReDoc
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    - OpenAPI YAML spec file
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- → For changes between v0.10.0 and v0.9.0 see the CHANGELOG.md
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  - 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 join or resign as a Contributor, please visit https://lists.camaraproject.org/g/sp-qod.
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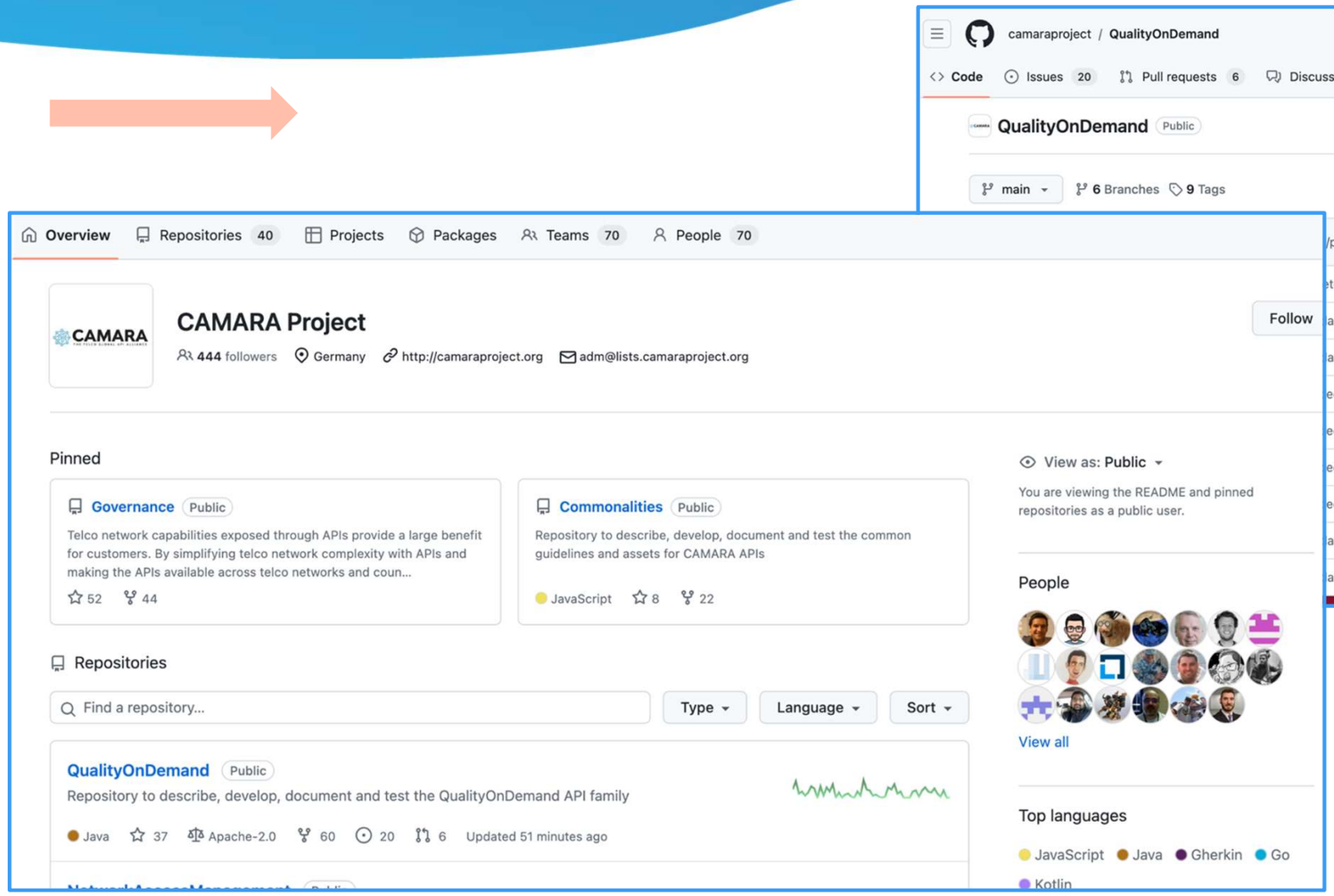
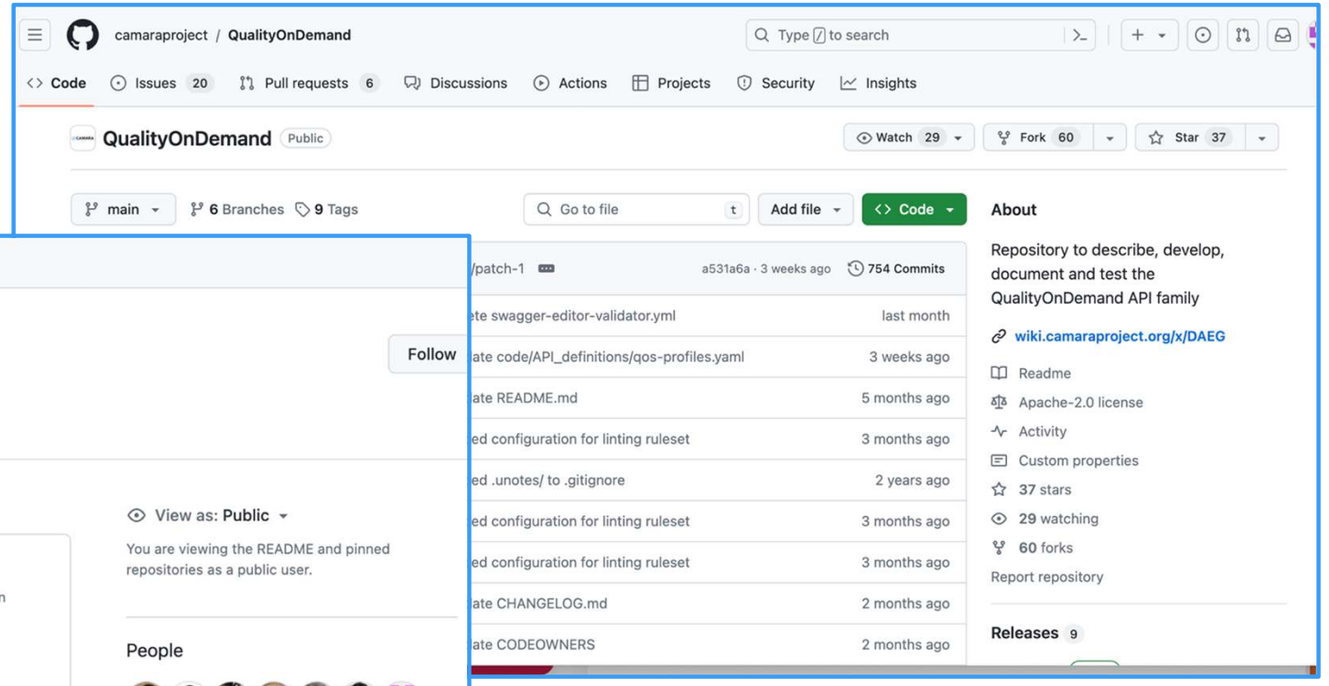
Developers Getting Started with CAMARA APIs

CAMARA
THE TELCO GLOBAL API ALLIANCE





Benefit for developers to work in CAMARA

CAMARA
THE TELCO GLOBAL API ALLIANCE

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

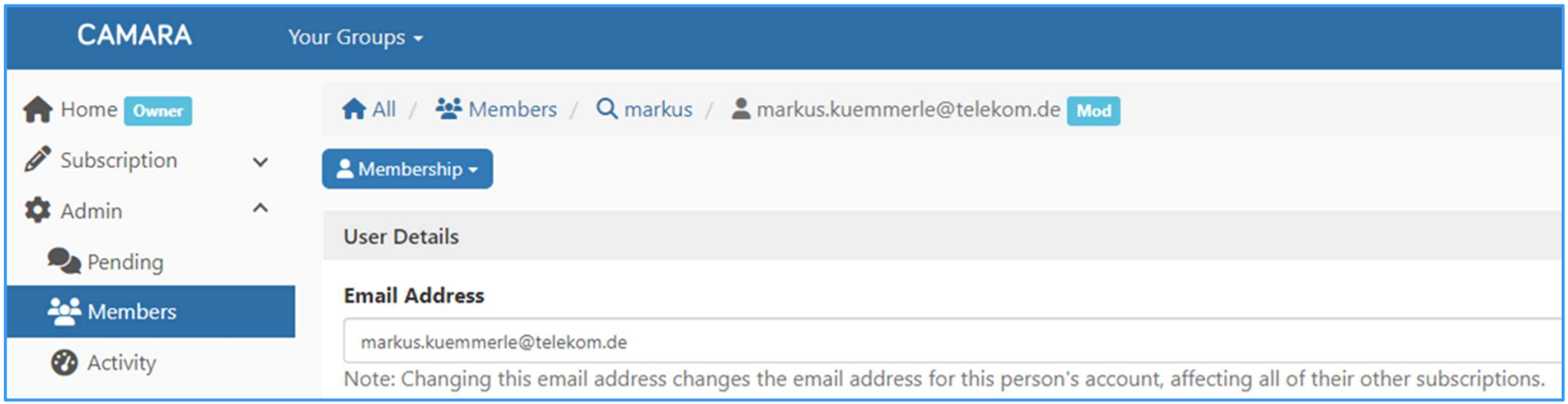
People who contribute define priorities and drive the direction.

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.

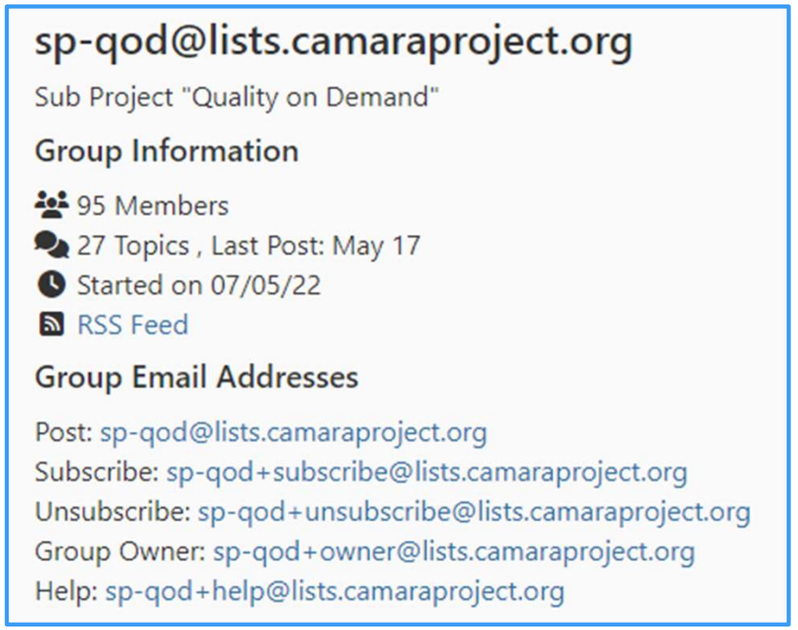
Joining CAMARA as Developer

CAMARA
THE TELCO GLOBAL API ALLIANCE

Each API family / working group in CAMARA is organized as a separate Sub Project 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

HD0



Folie 39

HD0 Need to be updated, seen in Release Management by Tanja

Damker, Herbert; 2025-03-25T16:24:53.931

Joining a Sub Project as Developer

CAMARA
THE TELCO GLOBAL API ALLIANCE

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

QualityOnDemand

Repository to describe, develop, document and test the QualityOnDemand API family

Scope

- Service APIs for "Quality on Demand" (see APIBacklog.md)
- It provides the customer with the ability to:
  - set quality for a flow within an access network connections (e.g. mobile device connection or fixed access between a home gateway and the service providers gateway router)
    - Session mode, for a specific duration
    - Provision mode, indefinitely for each time the device connects to the same access network
  - get notification if network cannot fulfill
- Describe, develop, document and test the APIs (with 1-2 Service Providers)
- Started: October 2021
- Location: virtually

Meetings

- 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

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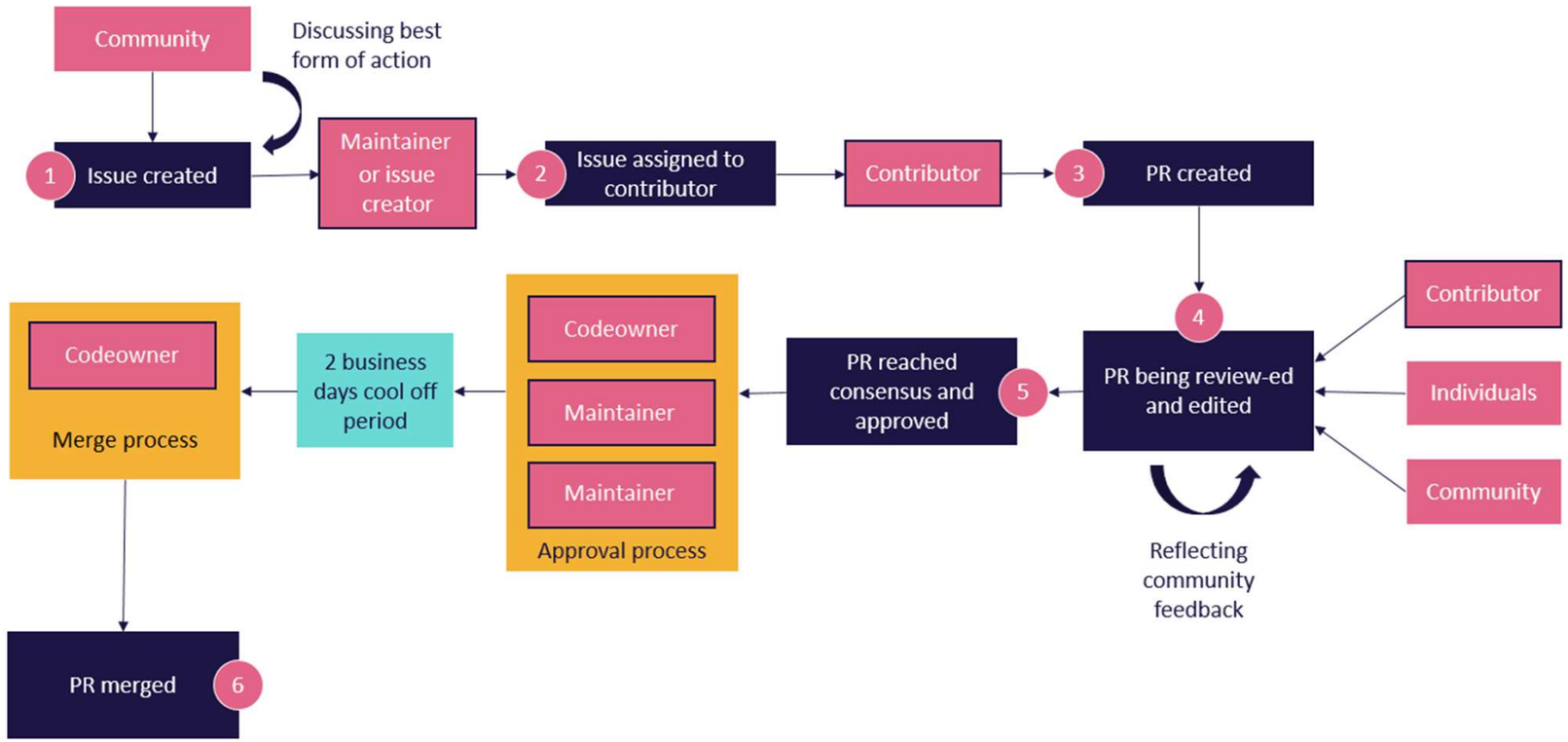
Contributing to CAMARA

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](https://github.com/camaraproject/Governance/blob/main/ProjectStructureAndRoles.md)

Benefit for operators to implement CAMARA APIs in their networks

Operators have made high investments in

- Spectrum licences
- Infrastructure (cell towers, fibre)

Operators haven‘t been successful in

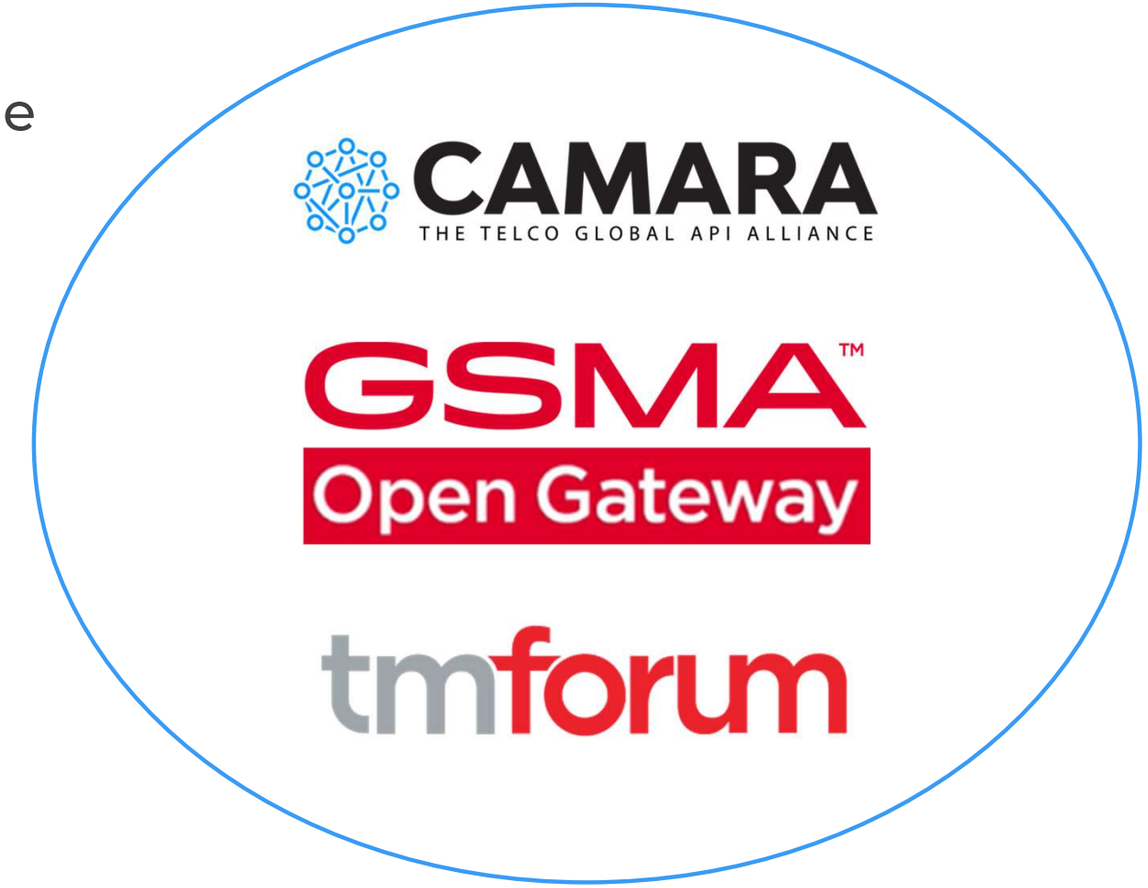
- Increasing prices for connectivity contracts

CAMARA APIs open a possibility

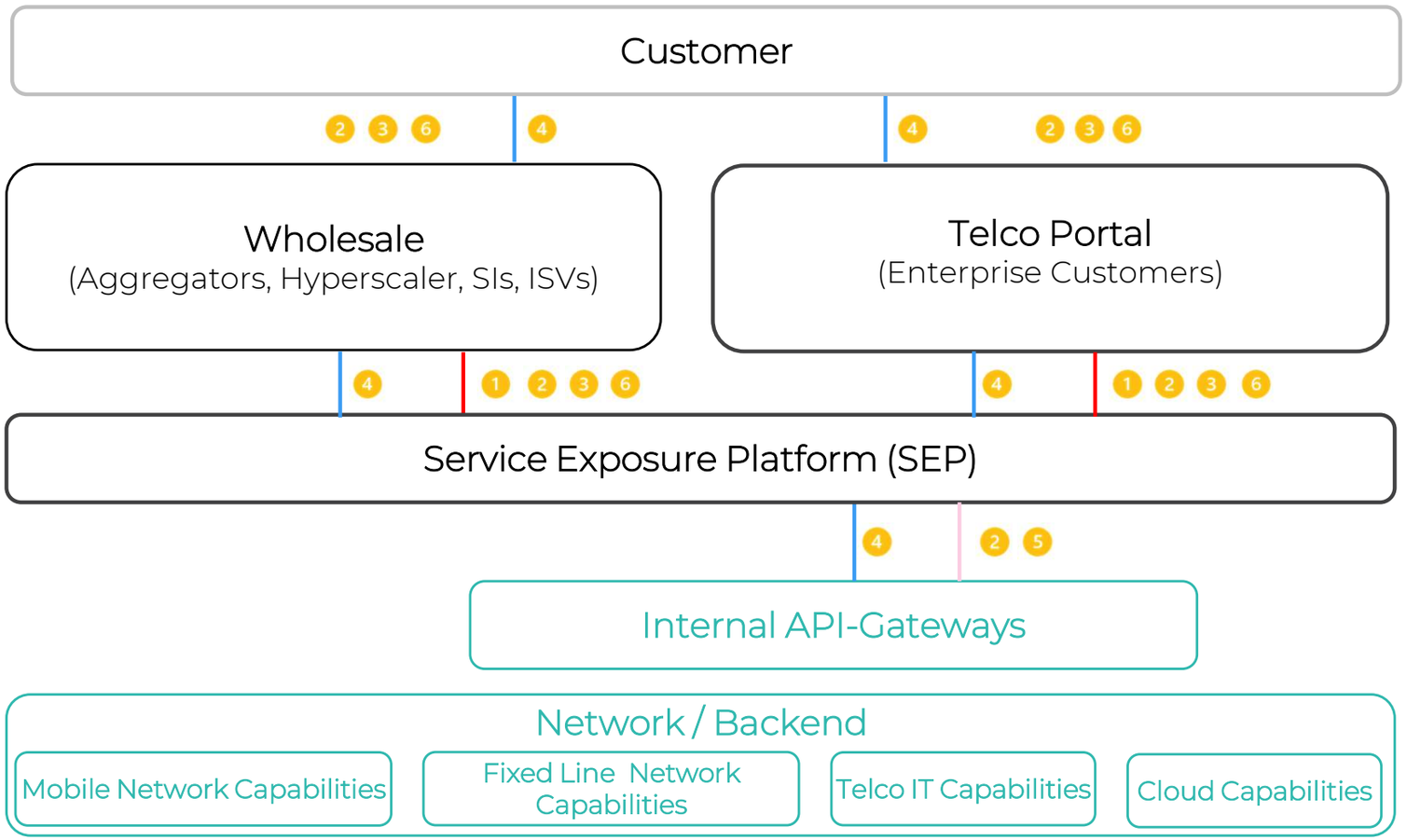
- To monetize the high investments
- To improve customer experience
- For market positioning

What have operators to do to implement Network APIs?

- Develop APIs and products based on the network capabilitites
- Implement an exposure infrastructure
- 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

CAMARA
THE TELCO GLOBAL API ALLIANCE

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

CAMARA
THE TELCO GLOBAL API ALLIANCE

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

CAMARA
THE TELCO GLOBAL API ALLIANCE

Individuals and organizations from API customers (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...

CAMARA
THE TELCO GLOBAL API ALLIANCE

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 (customers/developers and operators)

CAMARA Contacts

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

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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.

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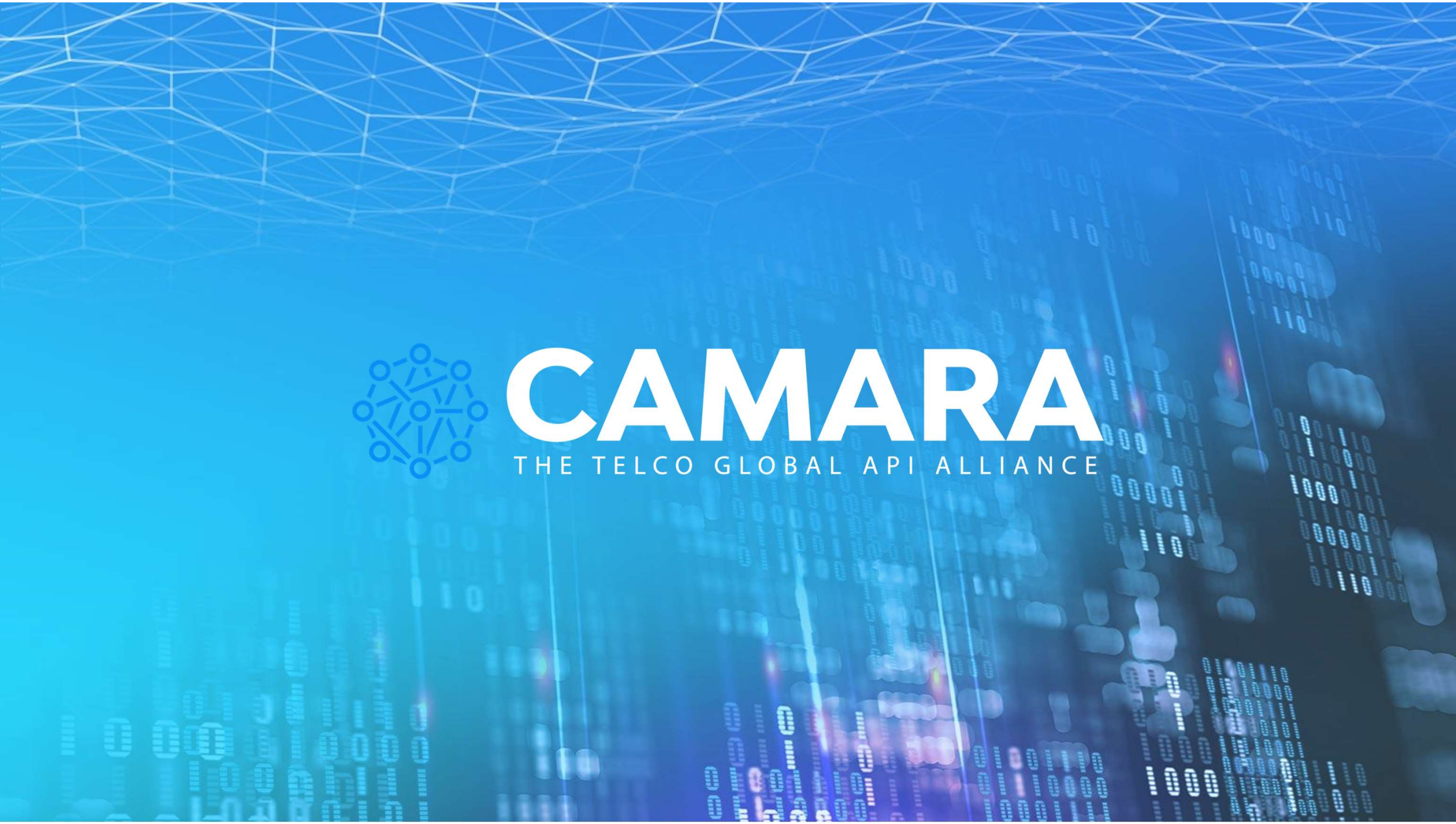
If you would like to join as CAMARA sponsor or associating organization, please don’t hesitate to use the enrollment link https://enrollment.lfx.linuxfoundation.org/?project=camarafund. Cost is depending on the kind of membership and the number of employees.


CAMARA
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