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.
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

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

<table>
<thead>
<tr>
<th>Scale</th>
<th>Consistency</th>
<th>Simplicity</th>
<th>Accessibility</th>
<th>Demand driven</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>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.</td>
<td>Telco networks are complex, and every network is different.... Developers want simple, intent-based APIs.</td>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>
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

**Abstraction**
Abstraction API Distribution Options

A. Single-Operator Relationship

B. Single-Operator “API Roaming”

C. Multi-Operator Relationship

D. Operator Aggregation
**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
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).
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.
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).
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 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.
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](https://github.com/camaraproject).
CAMARA
Where we started...

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

- 98 Named Partners
- 326 (+146*) companies participating in CAMARA
- 23 Active API development repos
- 972 (+923*) people joined CAMARA
- Development "home" for GSMA Open Gateway

* Number in brackets indicates companies and people who are in contact but haven't joined
CAMARA API Showcases

https://camaraproject.org/resources/
A common glue between Cloud Infrastructure and Earth Networks

Cloud Infrastructure
Enhancing virtual ‘Cloud’ applications & services to enable Web3.0

Open Service (Northbound) Common Network APIs
via CAMARA GitHub & GSMA Agreement Templates

Open Federation APIs (East West Federation & Interconnection)
via GSMA Operator Platform Specifications & Agreement Templates

GSMA
Telco Finder (N-E-W)
5G
Earth Networks

CAMARA
Service APIs (N)

tmforum
Operate APIs

Specification by Doing Code, not documentation
## Current CAMARA API Families (1)

<table>
<thead>
<tr>
<th>Blockchain Public Address</th>
<th>Call Forwarding Signal</th>
<th>Carrier Billing CheckOut</th>
<th>Click to Dial</th>
<th>Connectivity Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage a blockchain public address associated to a phone number</td>
<td>Determine if a “call forwarding” service is enabled</td>
<td>Purchase, pay, and follow up on fulfilment of products</td>
<td>Establish web-based communication by clicking an object</td>
<td>Alerts the consumers if and when the QoS threshold has breached</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device Identifier</th>
<th>Device Location</th>
<th>Device Status</th>
<th>Device Swap</th>
<th>Edge Cloud</th>
<th>Home Devices QoD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the identity of the subscribers’ device</td>
<td>Check the location of a device</td>
<td>Check the network connection and roaming status of a device</td>
<td>Check if the MSISDN has had a change of device in the last 30 days</td>
<td>Provide and manage network and compute resources for an application</td>
<td>Request prioritization of traffic on a specific device on the home network</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Identity and Consent Mgmt</th>
<th>Know Your Customer</th>
<th>Network Slice Booking</th>
<th>Number Verification</th>
<th>OTP Validation</th>
<th>Population Density Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides solutions to capture, store and manage user consent</td>
<td>Allows service providers to validate user information with operators</td>
<td>Reserve, dynamically provision, query, dynamically delete a slice</td>
<td>Allows users to verify the phone number of the connected device</td>
<td>To offer secure user authentication to service providers</td>
<td>Get dynamic population density data in a specific area for a future date &amp; time</td>
</tr>
</tbody>
</table>
Current CAMARA API Families (2)

<table>
<thead>
<tr>
<th>Quality on Demand</th>
<th>Region User Count</th>
<th>Short Message Service</th>
<th>Site to Cloud VPN</th>
<th>SIM Swap</th>
<th>Web RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows users to set mobile connection quality and get notifications</td>
<td>Query the number of active users in the specified area</td>
<td>Send SMS to the destination address(es)</td>
<td>Create and configure site to cloud network service by one click</td>
<td>Allows users to get information on SIM pairing changes</td>
<td>Add real-time communication capabilities to applications</td>
</tr>
</tbody>
</table>

CAMARA Working Groups:

<table>
<thead>
<tr>
<th>API Backlog</th>
<th>Commonalities</th>
<th>Marketing / Outreach</th>
<th>Release Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintains the API Backlog for CAMARA</td>
<td>Guidelines and assets mandatory for all CAMARA Sub Projects</td>
<td>Plans and performs marketing activities for CAMARA</td>
<td>Guidelines and assets for Release Management in CAMARA</td>
</tr>
</tbody>
</table>
CAMARA
Where are we going next...

1. Additional APIs and roadmap sync across CSPs, Aggregators and Hyperscalers

2. API lifecycle management consistency, Documentation of API versioning and availability globally

3. Support federation through GSMA and OAM through TM Forum
Customers (enterprises and startups), aggregators, cloud operators, telco operators, and network equipment vendors are welcome to join CAMARA. Participation is free, without any fees or obligation to work.

If you are interested in joining CAMARA, please subscribe to all+subscribe@lists.camaraproject.org. You may unsubscribe from CAMARA and these communications at any time.

In case of further questions, or if you would like to join as CAMARA sponsor or associating organization please don’t hesitate to use our contact page at https://camaraproject.org/contact/.